TOPICS OF THE MONTH

Chemicals and the Common Market

THE idea of a Common Market in Europe with the provision of a Free Trade Area is one that has dominated the thoughts of industry during the past month or so, and the general reaction seems to be one of uncertainty coupled with an optimistic feeling that what is lost on the 'swings' might well be gained on the 'roundabouts.' In such heterogeneous and complicated groups as the chemical and chemical engineering industries views naturally vary widely according to the type of product or machinery that is made. A number of firms feel that, while the Free Trade Area is something from which they might well benefit in the end, it is a question of whether the initial onslaught of overseas competition will sweep them out of existence before the necessary adjustments can be made. Other firms seem to approach the proposal in a spirit of adventure, while those who are obviously in a strong position are already setting about doing battle. It all seems to boil down to a survival of the fittest and most industrious.

In Britain, the chemical industry shows a balance in favour of the Free Trade Area, as is indicated in a statement from the Association of British Chemical Manufacturers. This statement reveals that, based on the assumption that the conditions and safeguards outlined in the 'Joint Report on a Free Trade Area,' either form part of the Free Trade Area Convention, or are otherwise assured, the majority of A.B.C.M. members are in favour of the Government's policy. The statement adds:

> Safeguards of special importance to the chemical industry are that a value criterion is essential as an alternative to any process criteria in determining the origin of goods and that there is need to strengthen the Customs Duties (Dumping and Subsidies) Act, 1957, so as to provide speedy means of dealing with short-term dumping. Attention is drawn to the artificial barriers to trade which exist as a result of official regulations governing the registration of pharmaceutical and food additive products and to the need to obtain visas before importation. Patents and trade marks are of special interest to the chemical industry which urges that speedy consideration of compulsory licensing requirements be undertaken and that anomalies in the application of Trade Mark Law in Western Europe should be removed if trade is not to be hampered or frustrated.

An example of the reaction to European free trade of a big organisation whose export of organic chemicals has been rising steadily is provided by Imperial Chemical Industries Ltd., whose formation of a new Heavy Organic Chemicals Division is reported elsewhere in this issue. Confidence that the new Division would thrive in the competitive conditions of a European Free Trade Area was expressed by Mr. T. B. Clark, commercial director designate of the new Division, at a recent Billingham conference on overseas markets. As Mr. Clark points out, the immediate task is to create a new attitude of mind, recognising Europe as a whole, not the U.K. alone, as the home market.

Chemical plant makers' reactions

IN the chemical engineering industry there is even less unanimity of opinion than in chemicals and it is obvious that the views of a firm offering, for instance, the design and construction of complete chemical plants are bound to be very different from those of a firm producing specialised types of process equipment or, again, one that deals in standard types of, say, pumps or valves. For Britain, Germany is obviously going to stand out against all other competitors. In some lines, British firms 'have the edge' over their German counterparts, while in others there will be a need for British firms to put on a spurt where more advanced technical knowledge or superior finish shows itself in the German product. In general comparisons between British or German engineering, British machinery, which is often superior in quality and in design, suffers as a result of the greater alertness of the Germans where selling and publicity are concerned. There is no doubt that in the advent of a European Free Trade agreement, many British firms will have to give much more attention to sales promotion, including the compilation of good, clear, technical sales literature—and in other languages besides English.

A good effect of European Free Trade on the chemical plant industry will be, in time, to give an impetus to technical development and, with the creation of a tendency to form larger firms, the improvement of production methods.

The smaller firms, and those who feel that, as things stand at the moment, European Free Trade will place them at a disadvantage, will take heart from the observation of one prominent personality in the chemical plant industry, Mr. G. N. Hodson, (see page 474), that the change will be a gradual one. For industry in general the main worry about any possible free trade agreement is, as Sir Hugh Beaver points out, whether action by any of the Governments involved may make it impossible to compete.

Underground gasification in Russia

SO much has been heard lately about objects that the Russians have been sending up into space that it is refreshing to turn to what they have been up to under the ground. As we go to press a party of British experts on underground gasification, which

left Britain on November 17, is doing just that. The party consists of representatives of the National Coal Board, Humphreys & Glasgow Ltd. (the contractors responsible under the N.C.B. for the pilot scheme at Newman Spinney near Chesterfield), and the consultants for the British project.

According to Dr. A. E. Balfour, the Humphreys & Glasgow representative, the Russians have been working on underground gasification since 1935, latterly on a big scale. To see just how far the Russians have got, especially with the technique using air, is the main object of the visit, while other interests are directional drilling; the Russians' use of oxygen with the possibility of producing gas of a higher calorific value then can be obtained by using air; and the possibility of establishing a regular exchange of information between the two countries.

New ideas in fertiliser granulation

USEFUL experiments have been carried out on rotary-drum granulators, used for the granulation of compound fertilisers. The swing to more concentrated fertilisers in the last ten years or so has frequently meant an increase in the salts/superphosphate ratio of the mixings to be granulated and the result has been increased difficulty in the granulation of many compounds, already complicated by the number of variables associated with rotary-drum granulators—*e.g.* speed of rotation, slope, position, number and type of water sprays, etc.

It has been found in a batch pilot unit that far higher granulation efficiencies were possible with such a unit than those normally attained on the works, and a number of factors have emerged from a study of such differences. Tests have shown, for instance, the importance of correct rolling of the material in the granulator drum and that correct speed promotes a pattern of rolling and cascading in the drum which, in turn, permits of a more uniform distribution of water in the solids. As a result of increasing the speed of the granulator on one plant from 9 to 12 r.p.m., it was possible to do away with other granulation aids previously fitted inside the shell, with improved results. Granulation efficiencies run regularly at over 80% between screen sizes of 1.75 and 4 mm.

The use of steam for granulation is perhaps the most interesting of modern developments, the steam being injected under the rolling bed of material in the granulator. In his paper to the Fertiliser Society in London on November 28 Mr. A. T. Brook, D.I.C., M.SC., A.M.I.MECH.E., who discusses the foregoing and other granulation developments at some length, gives examples of operating costs for steam granulation and makes the point that if a plant were designed from the start to produce fertiliser with a final moisture content below 1%, it would be appropriate to design the drier accordingly. If steam were not employed the extra cost of a larger building to accommodate it would be of the same order as the cost of a steam installation. The overall fuel requirements would be very similar.

Professors; are they civilised?

ORGANISING a university course, like being Chancellor of the Exchequer or editing a technical journal, is one of those things that everyone feels he can do better than the one who is doing it. Whether arts men get as heated up as scientists whenever the word 'education' is dropped among them cannot be established with certainty, although certain Angry Young Men are heard of in some quarters and it might be surmised that at least part of their ire is directed at arts courses. But whatever problems lie in that sphere there surely cannot be any *shortage* of Angry Young Men, so let us stick to the world of science. Here there is quite definitely a shortage and it is felt by many that the world would be a better place if only more young men were interested in dynamics rather than duffle coats and in chemistry rather than coffee houses.

Approaching then, in more sober mood, the problem of educating scientists and technologists, our sobriety receives something of a setback when we find, at a recent learned discussion on this subject, someone making the suggestion that, generally speaking, university science lecturers are not civilised enough and that, however knowledgeable they may be about science and all its ways, they are not capable of instilling the humanities into their students as they should. Another speaker capped this with the observation that there has been a tendency towards too much cramming with facts. There is no doubt more than a grain of truth in these observations, although it says much for the degree of civilisation attained by the many lecturers present that they refrained from commenting very much on them. Many an Angry Young Man would have jumped at the opportunity.

But the question of making provision for broadening the mind presents, quite seriously, one of the big question marks in the education of scientific and engineering students today. As Dr. R. P. Linstead put it, the feeling that the formal education of such students is not sufficiently broad has grown widely in various countries during recent years. In an effort to remedy this, a number of technical universities incorporate some teaching of non-scientific subjects into their curricula, but the extent to which this is done and how far it is compulsory or examinable varies very considerably. It cannot be said that a generally accepted solution has been found either in Europe or America.

Dr. Linstead, who is rector of the Imperial College of Science and Technology, London, was delivering the 9th Hinchley Memorial Lecture to the Institution of Chemical Engineers. In dealing with the subject of university courses he commented on a proposal to transfer much of the present sixth-form work from the schools to the universities and so revive something like the old intermediate year. This would be followed by three post-intermediate years. If this proposition was considered in isolation, Dr. Linstead pointed out, there would be no serious objection to it, but it cannot be so considered for we have to assess it in relation to the circumstances of the times, and

particularly the way in which the country is at present organised and equipped. The situation during the next decade will surely be governed in practice not by purely 'academic' considerations but by the solid and compulsive facts of the population bulge and the national need for qualified technologists. The universities will in any case have to shoulder a heavy load for which, on the whole, they are under-provided in buildings, equipment, and to some extent staff.

Another point against too much prolongation of the formal instruction, Dr. Linstead pointed out, was that, while a boy may think seriously of becoming an engineer or scientist at 15, he may be 25 by the time he is finally qualified and will go on learning by the practice of his profession for the rest of his active life, for 40 or 50 years.

In conclusion, Dr. Linstead observed that in the last analysis it was more important for a technological university to provide the facilities for a full life in humane surroundings than to organise classes for this, that or the other non-scientific subject. If education can be defined as that which remains when you have forgotten everything else you were taught, this is a most profound part of education.

Cause for some heat

IN this issue an article dwells on the advantages that can accrue from the use of filming amines in heat transfer; it seems a convenient jumping-off place for the reflection that films in general, such as air, water, scale, or burnt-on product, when they accumulate on the surface of heat transfer in process plant, do not help things much. In fact, each of them is more resistant to the passage of heat from the steam to the product than the metal wall of the heating surface itself.

With this observation a recent issue of *Chemical Topics* goes on to give an interesting example of the sort of disastrous effect that a film—on this occasion rather a strange one—can have. A brand-new vulcanising press had been installed in a rubber tyre factory, and, although it was supposed to be a vast improvement on the existing machines, in fact it was proving to be nothing of the kind; heating-up times were longer, optimum temperature was never attained and the unsatisfactory heat conditions were causing soft cures.

The first reaction of the experts who were called in was that something must be wrong mechanically with the float traps used to drain the press. They were tested and no fault was found. The steam supply side was checked and everything seemed to be in order.

Eventually the tyre former, which is a ribbed ring locked into the mould, was removed and the cause of all the trouble discovered. The entire heating surface of the mould was covered with a kind of shellac—possibly to prevent rusting during transit.

A small area of the shellac was scraped off and two temperature readings were taken—one on the clean spot and the other only two inches away on the shellac. There was a temperature difference of 35°F.!

After Windscale

IT is always easier to be wise after the event and since the facts about the accident at the Windscale atomic pile have been made known it is natural to come across a certain amount of armchair reconstruction of what happened, with some sage recommendations as to this or that course of action that might have been followed. However, it is difficult to see how the steps that were taken could have been bettered. It is one thing to review the Windscale events in comfort and security, and quite another to be one of those who, in the eerie atmosphere of the plutonium-producing reactor in the cold grey hours of the morning, fought a danger whose possible consequences did not bear contemplation by a means whose safety and reliability could not be established. One can visualise, for instance, the anxiety of those who worked desperately to clear the red-hot uranium cartridges that were jammed in their channels in the pile, and, later, of those who directed the turning on of water in a desperate effort to reduce the pile temperature. All this while rumour and counter-rumour were circulating, generated by the bewildered murmurings of the factory workers who were crowded under cover during the more hazardous operations.

In fact, between the matter-of-fact lines of the Government White Paper* on the subject can be read a story of steadfast devotion to duty and a refusal to be panicked. The men of Windscale fully deserve the Prime Minister's tribute to their courage, energy and resourcefulness during the crisis.

While the Committee of Enquiry's full report to the U.K.A.E.A., as a document dealing with the design and operation of a defence installation, is being kept secret, the White Paper makes clear how the accident was discovered and the steps that were taken to put things right and to safeguard both the factory workers and the general public. Salient facts are that the accident occurred during a routine maintenance operation, the controlled release of stored 'Wigner' energy from the graphite of the pile, and that the immediate cause of the accident was the application too soon and at too rapid a rate of a second nuclear heating to release the Wigner energy from the graphite, thus causing the failure of one or more cartridges in the pile, whose contents then oxidised slowly, eventually leading to fire in the reactor. The Authority ascribe the accident partly to inadequacies in the instrumentation provided at Windscale for the maintenance operation that was being performed at the time of the accident and partly to faults of judgment by the operating staff, these faults of judgment being themselves attributable to weaknesses of organisation.

If there is a moral in this for other industrial undertakings whose operations involve hazards of any kind, it is that even in the best of organisations there may be a weak spot and wherever hazards exist no safety code can be too rigid. As it was, the prompt and effective measures taken at Windscale to deal with the accident were the means of maintaining the U.K.A.E.A.'s proud record of safety.

*Comnd. 302, H.M.S.O., 1s. 3d.

Air pollution studies

IN the battle against air pollution, a particularly difficult gas-cleaning problem has resulted from the rapidly growing use of oxygen in steelmaking. This process produces a reddish oxide fume that is comparable with tobacco smoke in its fineness. It is therefore very difficult to clean except at great cost. Pilot-plant investigations are proceeding in the hope of improving wet scrubbing methods.

In parallel with this, work is being undertaken to discover the cause of iron-oxide fume formation. There are two conflicting theories. One is that iron carbonyl is formed, which subsequently decomposes into iron and carbon monoxide, the iron being then oxidised to produce iron-oxide fume. The second theory is that during oxygen refining the temperature of the hot metal can rise locally to as much as 3,000°C.; the vapour pressure of iron increases considerably with increase in temperature and, therefore, iron vapour is formed which is oxidised directly to produce reddish fume. Although the results of experiments so far are inconclusive, there is some indication that a relationship exists between the carbon content and the volume of fumes when iron is heated in oxygen up to about 1,600°C.

These and other research projects are discussed by the British Iron and Steel Research Association in the 1957 edition of their *Survey*.

Processing fission products

WITH the demand for its radioactive products trebled during the past three years, the Radiochemical Centre at Amersham, Bucks., has had good cause for increasing in size. The new laboratory inaugurated last month is the second part of a group of buildings specially designed for processing radioisotopes, of which the first was commissioned in 1954. It will accommodate the same type of work; that is, the separation of pure radioactive isotopes from materials irradiated in atomic reactors, the synthesis of 'labelled' compounds for research, and the manufacture of radiation sources for industrial and medical use. There is also need for producing increased quantities of the 'minor' fission products—promethium, cerium-144, yttrium-91, zirconium and niobium-95, etc. For these purposes a 'hot cave' facility is being constructed and is about half complete. It comprises three inter-connecting compartments which can accommodate activities up to 1,000 curies of caesium-137. The shielding is 3 ft. of high-density concrete bricks, vision is through windows containing concentrated zinc bromide solution, and for manipulation within the cells three pairs of the Argonne pattern of master-slave manipulators are being installed. These caves are intended for chemical work with highly toxic materials and it has therefore been necessary to provide them with enclosed metal liners, each measuring about 7 ft. × 8 ft. × 15 ft., which will be kept under slightly reduced pressure to prevent the escape of radioactive dust. This is the first time in Britain, or elsewhere so far as is known, that these manipulators have been used for this class of work within caves which are not only fully shielded, but completely enclosed. Access to the caves, when servicing is necessary, will be made by the 'captive man suit' technique.

Uphill work on pressure drop

WITH cross-country pipelines becoming increasingly important throughout the world it is not surprising to find engineers giving a great deal of attention to such matters as pressure drop and pressure surges and, from data submitted at a conference held by the American Society of Mechanical Engineers at Tulsa, Oklahoma, in September, it is obvious that this is a difficult field of investigation where much ground has still to be covered.

One research project was aimed at studying the effect of uphill and downhill flow on pressure drop, and recent field results show that excessive pressure drops have been encountered in two-phase pipelines through hilly country. This work was reported by W. E. Brigham, E. D. Holstein and R. L. Huntington, who described how they set up apparatus to examine what happens in two-phase systems. A double loop of clear plastic tubing of 1.975 in. internal diameter, and with an overall length of 27 ft., was mounted on an angle-iron frame which could be adjusted to various inclines. Lubricating oil or water was used as the liquid phase and air as the gas phase.

The flow patterns found were similar to those reported by White and other investigators; however, there was one notable exception. The region of stratified flow as recorded by Alves, White, Bergelin, Gazley and many others did not exist even in horizontal flow. Stratified flow involves a pattern which is characterised by a change in interfacial height along the length of the pipe. A logical conclusion that can be drawn is that, if there is any irregularity in a pipe, such as a bend or slight dip, stratified flow will not exist at all and the flow at low gas rates will be slug type. The results of this investigation bear out this conclusion.

Typical pressure-drop data for oil and air at (*a*) a 12.4° slope, and (*b*) the horizontal position, are compared, and one interesting point noted is that there is a change in the flow pattern whenever the air rate exceeds 16,000 lb./hr.sq.ft. It is also of interest to note that at the lower air rates the pressure drop is much greater at the 12.4° incline than at the same rate in horizontal flow—greater by as much as three to four times. Since the inlet and outlet pressure taps for the test loop were at the same level, this inequality cannot be due to a change in head, but can only be a result of the irreversible losses in slug-type flow. In single-phase flow the potential energy head at the top of a rise is regained as pressure energy as the fluid flows downhill, but in two-phase flow the flow pattern changes from slug on the uphill side to stratified on the downhill side and the potential energy is not regained. However, once a steady flow pattern with little pressure fluctuation such as wave, cresting or semi-annular is reached, the pressure drops at horizontal and at an incline are identical.

Filming Amines as an Aid to Heat Transfer

By T. B. Fielden, A.R.I.C.
(*Chief Chemist, Rodol Ltd.*)

Of interest primarily for their role in inhibiting corrosion, filming amines also have another function that is of interest to the chemical engineer and can be seen to have possibilities for effecting economies in the design and operation of certain types of steam-heated plant used in a number of industries.

THE use of filming amines as corrosion inhibitors in steam and condensate systems[1] is becoming well established. Owing to the thermodynamic instability of iron, and its tendency to convert to oxidised states, contact with almost pure water containing dissolved oxygen and carbon dioxide is potentially destructive. These gases arise from the boiler feedwater, and, whilst it is possible by thermal and chemical means to remove them, in many cases this is not done at all, or only incompletely.

Addition of chemical treatments to the steam can afford a great measure of protection; volatile amines such as cyclohexylamine and morpholine have proved most effective in neutralising carbon dioxide, and giving an alkaline *p*H value to the condensate. In this case the action is purely chemical, and reduction of corrosion due to oxygen is only limited. These amines are characterised by their high basicity and solubility, in contrast with the filming amines, which are only sparingly soluble, and, therefore, have little or no effect on *p*H values. This contrast in physico-chemical properties is reflected in their mode of action, which it will be seen is of importance in two aspects.

Chemically, filming amines are primary aliphatic amines, with a chain length of 16 or 18 carbon atoms giving the optimum results.[2] Whilst in the vapour phase (*i.e.* dry steam) there is no effect, but immediately condensation occurs the polar $-NH_2$ group is attached to the metal surface, and the long chain is oriented over the surface giving a layer of approximately monomolecular thickness. This thickness is not exceeded as there is then no attraction between surface and amine, so further supplies coming through with the steam act as replenishers for mechanical losses, only 1-5 p.p.m. being required to build up and maintain the film.

For corrosion to occur, there must be intimate contact between the corrosive medium and the metal, and, as the amine film is continuous, the primary corrosive reactions are stifled. Almost complete inhibition is obtained, and, as this is a physical mechanism, protection against both oxygen and carbon dioxide is much superior to the neutralising amines. In addition, and this will be our main consideration here, the film is water-repellent, tending to promote dropwise condensation of the steam.

Effect of dropwise condensation

Water vapour condensing on a cooled metal surface will form as either a continuous film or as drops, depending upon the state of the surface.[3] On a clean surface continuous condensation will always occur, but, in practice, owing to the presence of oxides and possibly oils and greases, a certain amount of dropwise condensation will take place in conjunction with other parts of the surface where a film of relatively greater thickness forms. By the promotion of dropwise condensation using filming amines a substantial increase in the rate of heat transfer may be obtained; the reasons for this are fourfold:[4]

(1) Heat conductance through the surface of drops is more rapid than through an equivalent quantity as a film.

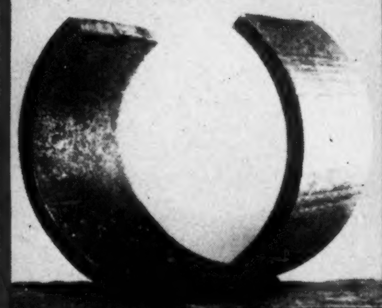
(2) Liquid is removed more rapidly as the drops roll down and coalesce.

(3) A greater area of metal is exposed to direct steam heat.

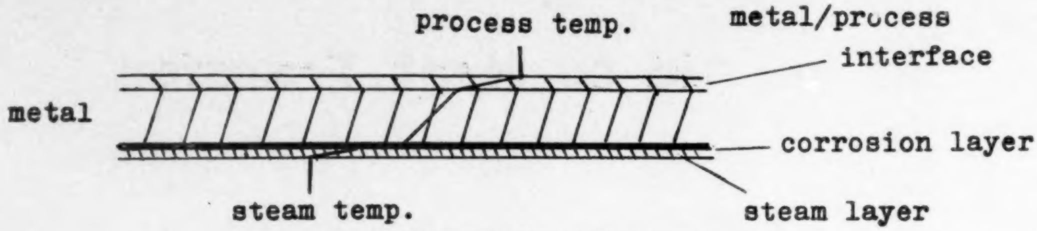
(4) It is found that old corrosion deposits are removed; these may be of some thickness, and have a low thermal conductivity.

Heat transfer calculation

Whilst a quantitative assessment of the actual increase in any specific instance is not possible without detailed knowledge of the plant, consideration of some of the factors involved will be of assistance. The overall rate of heat flow (Q) is equal to the product of the heat transfer coefficient (U), the surface area of the metal (A), and the temperature differ-



Dropwise condensation brought about by treatment with filming amines.



Heat transfer to a steam-heated process.

ential between the steam and the process, *i.e.* $Q = UA\triangle t$.

Assuming, for the moment, that A and $\triangle t$ are constant, and concentrating on U, this is affected by the various components of the system between t_1 and t_2, *i.e.* steam and process, and these comprise: (*a*) the condensate film, (*b*) the corrosion film (if present), (*c*) metallic wall and (*d*) interface between metal and process.

$$\text{Now } U = \frac{1}{\frac{L}{K} + \frac{1}{h_1} + \frac{1}{h_2} + \frac{1}{h_3}}$$

where L = thickness of metallic wall (in.), K = conductivity of metal (B.Th.U./hr./sq.ft./°F./in.), h_1 = conductance of condensate film (B.Th.U./hr./sq.ft./°F.), h_2 = conductance of corrosion film (B.Th.U./hr./sq.ft./°F.), and h_3 = conductance of metal/process interface (B.Th.U./hr./sq.ft./°F.).

Taking a mild-steel wall of 0.25 in. thickness, a corrosion film of iron oxide 0.01 in. thick, filmwise condensation (conductance, say, 1,000 B.Th.U./hr./sq.ft./°F.), and as an approximation, 500 B.Th.U./hr./sq. ft./°F. as the conductance of the metal/process interface, we get:

$$U = \frac{1}{\frac{0.25}{312} + \frac{1}{1{,}000} + \frac{0.01}{1.5} + \frac{1}{500}} = 95.5$$

Where dropwise condensation takes place the conductance of the condensing steam, according to conditions, will be between 12,000 and 15,000 B.Th.U./hr./sq.ft./°F., so taking a value of 14,000 under similar conditions:

$$U = \frac{1}{\frac{0.25}{312} + \frac{1}{14{,}000} + \frac{0.01}{1.5} + \frac{1}{500}} = 104.8$$

When the corrosion film has been removed the figure for U then becomes 348.0. For comparison purposes, if there is no corrosion film, and with filmwise condensation U would be 263.

Paper industry applications

It will be seen that a considerable increase in the rate of heat transfer may be obtained, although the above figures do not represent the actual increase over the whole process. At the present time, most of the practical applications have been in the paper industry, where the rate of production is governed by the drying capacity of the rollers, and sufficient evidence has been gained to demonstrate conclusively that dropwise condensation is obtained with resultant increase in roller speed or reduction in steam requirements.

Results so far indicate that the actual increase in drier efficiency will be between 5 and 10%, and this may be brought about either by increasing the roller speed or decreasing steam pressure. Some typical cases show that the temperature differential between steam and paper is reduced by about 12°.

Further possibilities

The foregoing only applies to existing plant, where the surface area available for heat transfer (A) is constant, but interesting possibilities also exist where new plant is under consideration. In such cases it is clearly possible to reduce the surface area and still obtain the same rate of heat flow Q, provided that a filming amine is always dosed into the steam. This will apply to a wide range of industry, and comprises turbine condensers, evaporators, and indirectly steam-heated equipment of all types. A higher rate of heat throughput should also tend to reduce deposits on the process side of certain evaporating plants, for instance, those used to evaporate sea-water, milk, and sugar liquors.

The other factor involved in the heat transfer equation, $\triangle t$, also assumes importance; cases have occurred where the permissible steam pressure is limited, and the time involved for carrying out a particular process is governed by this. By the use of filming amines, the same steam pressure will give a higher temperature on the process side, or, alternatively, steam pressure may be reduced.

All metals normally employed are found to exhibit dropwise condensation, including copper, brass and austenitic steels. The major benefit in these cases will naturally result from the condensation aspect, whereas with mild steel and cast iron the removal of corrosion products may well be of even greater importance. The film is stable for comparatively long periods, so that a temporary cessation of treatment will not result in the onset of corrosion, or the return of filmwise condensation conditions. Injection of the amines need not, therefore, be on a proportionate basis, and a simple continuous addition is all that is required. The prescription varies slightly according to the size and disposition of the system and the steam velocity; an analytical method for the determination of primary amines is available, periodical tests ensuring that sufficient is present to maintain the film.

Great interest is being shown in this form of treatment at the present time, and it is hoped that the foregoing will show the two-fold aspect deriving from its use. Whichever aspect merits the greatest consideration will be dependent on many factors, but there can be few steam users who will not find one or the other, or possibly both, of value.

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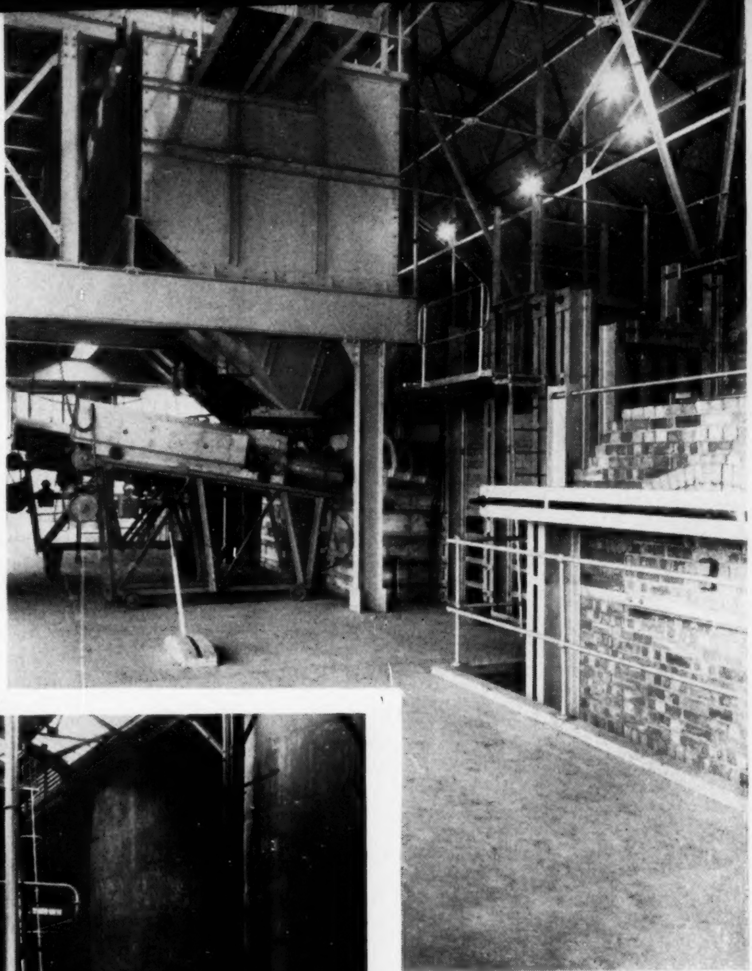
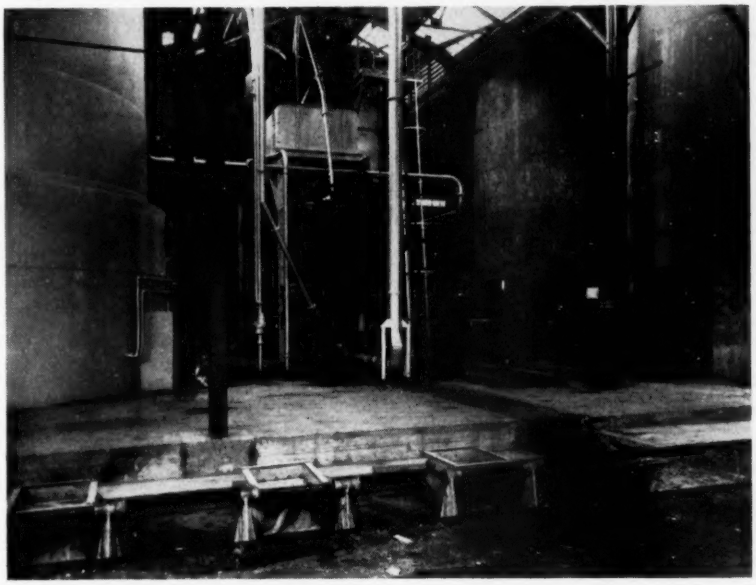
Sodium Silicate Expansion

A big new automatic plant brings the manufacture of sodium silicate glass to southern England.





Above: **The new furnace at Bow. Sand and soda ash are pre-mixed automatically and conveyed to the hoppers above the furnace: from this they are passed into the chargers in which a worm conveyor feeds them continuously into the furnace. Part of the heat regenerator is seen in the foreground on the right.**

Left: **In this building bulk soda ash and dry sand are stored in silos and accurately measured quantities of each are mixed automatically, ready for fusing in the furnace. In the foreground are the soda ash inlet chutes.**

THE bringing into production of a big new furnace for the manufacture of sodium silicate, at the Bow (London) factory of Joseph Crosfield & Sons Ltd., reflects an increased demand for silicates in the London area and throughout southern England generally. This demand is now 300% greater than when Crosfield's installed their first dissolver at Bow in 1938. Even at that time sodium silicate in both glass and solution form had been produced for years at the company's Warrington factory, and the glass has continued to be made in the north up to the present.

The new furnace at Bow represents an investment of well over £300,000 and the most important change it brings is that Crosfield's will no longer have to transport silicate glass from Warrington—a great advantage in offsetting continually increasing freight charges. Sodium silicate itself is a cheap commodity and the cost of distribution is therefore a high proportion of the total costs.

Another significant effect of bringing the new furnace into production is that supplies of basic silicate will be released for experimental work in the development of silicate chemicals. An example of this is calcium silicate which the company launched recently.

Automatic handling of raw materials

The manufacture of silicate glass at Bow is almost entirely automatic so that handling of the materials is reduced to a minimum. The raw materials, sand and soda ash, are brought in by rail, the sand in 13-ton wagons and the soda ash in covhops each carrying 16 tons.

The sand wagons are lifted bodily by the wagon tipper, discharging their load into a storage hopper. The sand

is carried by elevating conveyor into the sand drier—a rotating cylinder with a centre tube through which the products of combustion from an oil heated furnace are passed. The sand falls on to the tube and moisture is dried out as it passes through. The dry sand falls into a pit from which it is carried by bucket elevators to an overhead, rubber band conveyor discharging into the sand silo.

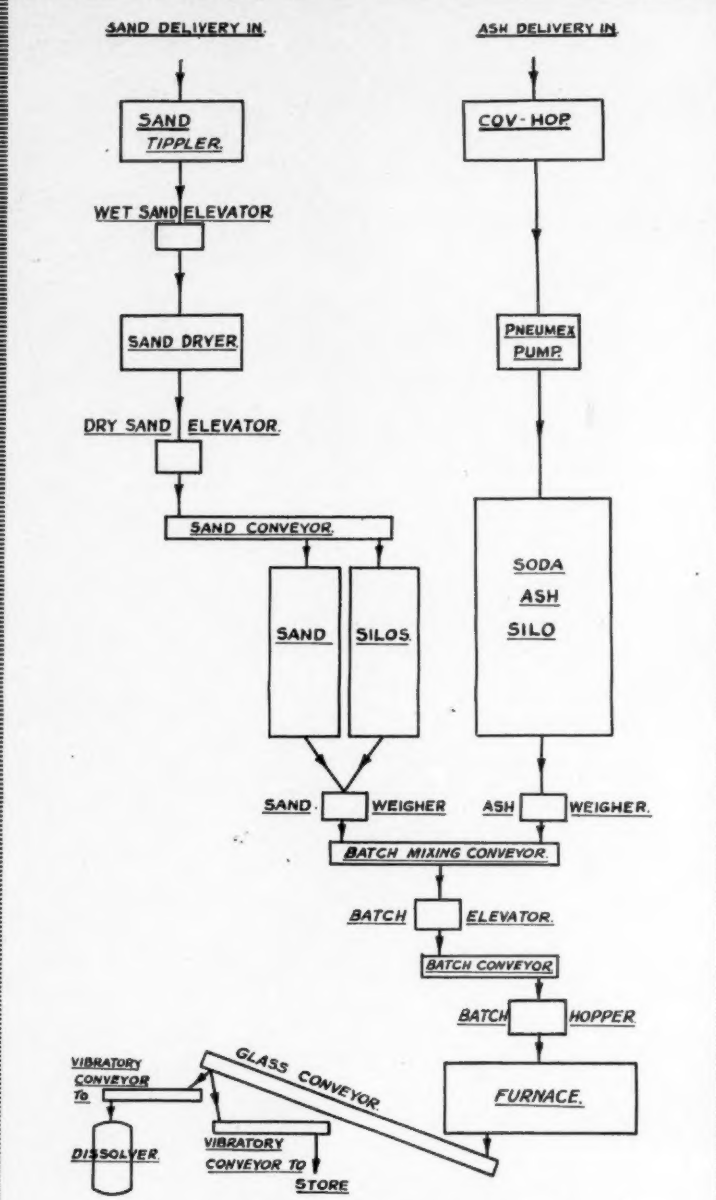
Bulk soda ash is passed through a fully automatic, electro-pneumatic system. The covhop rail wagon is drawn into position so that the outlets are immediately above four pneumatically operated inlet chutes between the lines. The chutes are raised to fit closely round the outlets, the joints being closed by foam-rubber washers. When the outlets on the covhop are opened the ash falls into the *Fluidor* conveyor, consisting of a series of aeration boxes which 'fluidise' the ash so that it flows like liquid into a *Pneumex* pump which blows it by air pressure into the silo or service hopper.

To prevent caking, a second *Fluidor* conveyor draws ash from the silo back into the intake hopper, from which it again passes through the pump and is either returned to the silo or blown to the service hopper. Thus the material is kept almost constantly in motion so that it cannot coalesce.

To prevent wastage the exhaust air is passed through a filter which extracts any soda ash which may be present, returning it to the system. The *Fluidor* conveyor operates at a pressure of 20 in. water gauge and the *Pneumex* pump at 40 p.s.i. pressure.

SIDELIGHTS

- ★ **Joseph Crosfield are the largest manufacturers of sodium and potassium silicate in the United Kingdom, besides being one of the largest soap and detergent manufacturing companies in the Unilever Group.**
- ★ **They are also the only Unilever company producing inorganic chemical products.**
- ★ **The company trace their history back to the original soap works set up at Warrington in 1814; it was Gossage's discovery of sodium silicate as a soap improver about the middle of the 19th century which first led Crosfields to build small, batch furnaces to produce this chemical.**
- ★ **The Bow installation is claimed to be the only complete manufacturing unit in the south of England capable of producing silicate as glass or liquor.**



Flow diagram for sodium silicate manufacture.

Mixing

From the two service hoppers, measured amounts of dry sand and soda ash are fed into two Simon automatic weighers which ensure that the correct proportions of the materials are passed to the batch mixer. The mixture is then conveyed by a worm conveyor to a bucket elevator which carries it up to hoppers above the furnace; this feed is automatically

controlled and the high and low levels of the mixture in the hoppers are indicated by lights.

The mixed sand and soda ash then falls into the batch feeders, the flow being controlled by valves at the base of the hoppers and the batch is conveyed into the furnace by means of the worm conveyor in the batch feeder.

Fusion

The furnace is oil-fired from either end on a 30-min. cycle and each battery of jets has its attendant regenerator through which the hot gases pass; the regenerators serve to preheat air to the jets, giving maximum cumbustion to the atomised oil and reducing smoke to the minimum.

The furnace is maintained at an approximate temperature of 1,400 to 1,500°C., at which the sand and soda ash are fused, forming silicate glass. The molten glass pours over a lip opposite to the charging side of the furnace and falls direct into a bucket conveyor. As the glass travels up this elevating conveyor it cools and solidifies.

From the top of the conveyor solid glass can be routed through three outlets:

(*a*) Passing directly to the storage silo;

(*b*) Being fed on to a vibrating conveyor to which chutes can be fitted at selected points along its length to draw off the glass and direct it through traps to the desired section of the silo;

(*c*) To a second vibrating conveyor which carries it direct to the dissolvers for further processing.

Although the company has to cover depreciation on a new plant and increased carriage costs on one of their raw materials, they hope that carrying out the complete manufacturing process at Bow will enable them to continue still further the price stability which they have maintained since 1955.

The company anticipate, too, that some of the silicate from the new furnace will be exported, probably in its glass form.

Construction

King, Taudevin & Gregson were the furnace builders and acted as the main contractors. Sub-contractors included the F. C. Construction Co. Ltd., Derby (civil engineering); Lambhill Ironworks Ltd., Glasgow (structural steelwork); Polysius of Ascot (bulk handling equipment for soda ash); and Edgar Allen, Sheffield (sand drying plant).

£ £ £

COSTS

September figures to add to our month-by-month indices are:

Plant Construction Index 173.6

Equipment Cost Index 163.7

Readers who have not a complete record of all the cost data we have published to date will find a useful guide in our Annual Index for this volume (pages 493 to 496, see under 'Cost Indices'). This shows the back numbers that should be consulted for the various articles on chemical plant and labour costs, personnel requirements, graphical and tabulated data on both British and American chemical plant costs, etc.

Since we first introduced them in January this year these Cost Indices have aroused increasing interest throughout the chemical and process industries. We invite readers to submit their comments on the subject of chemical engineering cost data to:

The Editor,
CHEMICAL & PROCESS ENGINEERING,
Leonard Hill House,
Eden Street,
London, N.W.1.

£ £ £

Recent Publications

Spontaneous heating. Copies of a booklet on this subject can be obtained from the Fire Protection Association, 15 Queen Street, London, E.C.4. This booklet describes the different ways in which ignition can occur, and includes classified lists of substances liable to spontaneous heating.

Detergent additives. A new pamphlet from Marchon Products Ltd., Whitehaven, Cumberland, is intended as a brief survey of the *Empilan* range of detergent additives, including those for both powder and liquid detergents.

Feeders. Vibratory feeders, type SU feeders and a high capacity feeder up to 1,000 tons/hr. are illustrated in separate leaflets from the Magnetic Equipment Co. Ltd., Lake Works, Portchester, Hants.

Dermatitis control. Bakelite Ltd., 12-18 Grosvenor Gardens, London, S.W.1, have published a useful technical memorandum on dermatitis control in the handling of epoxide resin systems. It includes brief case histories of several employees of the firm who suffered dermatitic effects from working with diethylenetriamine and suggests a number of precautionary measures.

Fertilisers. A 28-page illustrated booklet published by Fisons Ltd., Harvest House, Felixstowe, Suffolk, reviews the past achievements, the present performance, and plans for the future of the company. Special sections are devoted to the fields of fertilisers and heavy chemicals, agricultural chemicals, pharmaceutical and industrial chemicals, ethical pharmaceuticals and proprietary products.

Safety regulations. Under the title of 'I.C.I. Engineering Codes and Regulations (Safety),' a revised and extended version of I.C.I.'s Engineering Safety Standards has been published by that company and is made available to industry as a whole through the Royal Society for the Prevention of Accidents, Industrial Safety Division, 38 Millbank, London, S.W.1. The latest edition to appear is the first of a series dealing with safety in relation to electrical engineering.

Roll cladding. Rose, Downs & Thompson Ltd., Old Foundry, Hull, have published a leaflet, No. 601, which describes the new and patented process the company is introducing in Britain for the external cladding of rolls, shafts, tubes and drums with stainless steel.

Reinforced plastics manufactured by Fibreglass Ltd., Ravenhead, St. Helens, Lancs., are the subject of a 36-page booklet published by the company which provides information on moulding techniques, design and fabrication, properties and applications.

Nitrile rubbers. British Geon Ltd., Devonshire House, Piccadilly, London, W.1, have published technical booklet No. H.1 dealing with *Hycar* nitrile rubbers. Separate sections are concerned with the nature and property of the rubbers, and the processes of compounding and processing.

Sealing joints. A 28-page booklet has been published by Expandite Ltd., Chase Road, London, N.W.10, on their range of fillers and sealing compounds to accommodate movement in the joints of civil engineering and building structures. The illustrations show equipment used and typical applications.

Plastics review. A new booklet deals with the applications of plastics materials made by Bakelite Ltd., 12-18 Grosvenor Gardens, London, S.W.1.

CENTRIFUGING

By E. Broadwell

Part 2*. . . Centrifuging in the oils and fats industries; soap production; sugar refining; chemical and miscellaneous fields; new auxiliary devices

Vegetable oil

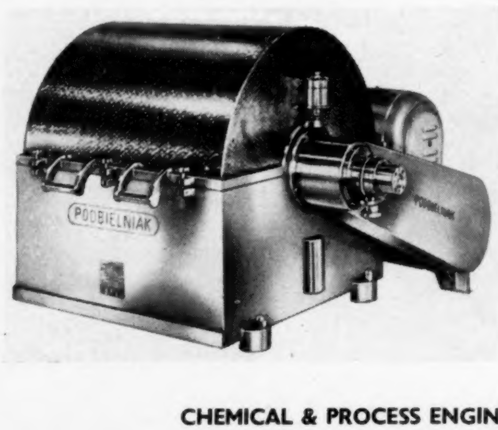
As in previous reviews, references to centrifuges in this particular field of application are numerous and diverse. Sullivan[106] has given some further data on degumming soyabean oil using the De Laval hermetic separator. Savings in oil amount to 0.58% over other systems, due to the high acetone insolubles of the gums. The report also indicates the advantage of this type of separator in the soda ash refining system as well as for ammonia refining where a pressure system is virtually essential. Hermetic centrifuges are also applied to degumming cottonseed oil,[107] which is now converted to degumming in the miscella state,[108] and owing to difficulties in arriving at the cup refining loss, a laboratory centrifuge technique is suggested. A further refinery is operating a cottonseed miscella refining system using centrifugal separators.[109] The lower viscosity and the greater density difference between the miscella and soapstock are distinct advantages in reducing losses and increasing the output of the centrifuges. General details[110] and the development[111] of the De Laval short mix centrifugal refining system have been reported and some data with particular reference to cottonseed oil refining are included in the latter.

The potentialities of the Podbielniak extractor are also being investigated in this field; a description of the *Duozon* and its application to degumming processes is given[12, 112] and two such machines in series are suggested for caustic and acid refining systems.[113] Two further reports[114, 115] deal with the operation of two pairs of Podbielniak machines working in parallel/series respectively for refining soyabean oil, using acetic anhydride for degumming followed by water washing. Some loss data are presented, but there are discrepancies which are not accounted for.

The background and development of the various Sharples continuous centrifugal refining systems which are available have been reviewed.[116] A complete research and demonstration refinery for investigating oil processing by the various systems is available in America and flow diagrams and the plant employed are indicated. A typical operation of palm oil refining using the modified caustic process through the research refinery is described. Additional information on the *Low Loss* process is given by Hayter[117] and some cost comparisons between batch and continuous centrifugal refining are quoted. A modified soda ash refining procedure is also available,[118, 119] developed as a result of tests in the Sharples research refinery; the latter review also gives a costs comparison. The broad outlines of the seven centrifugal methods of refining which are available are reviewed by Smith[120] and the physical aspects of soapstock to give best centrifuging conditions are considered. A review of a similar nature has also appeared[121] and general details of the De Laval and Sharples systems are given in a further article.[122] Some further information on the Sharples three-stage centrifugal soapstock splitting process has been given by Keith *et al.*[123] It appears to be a somewhat complicated process, but the data presented show a thorough examination has been undertaken of the process variables.

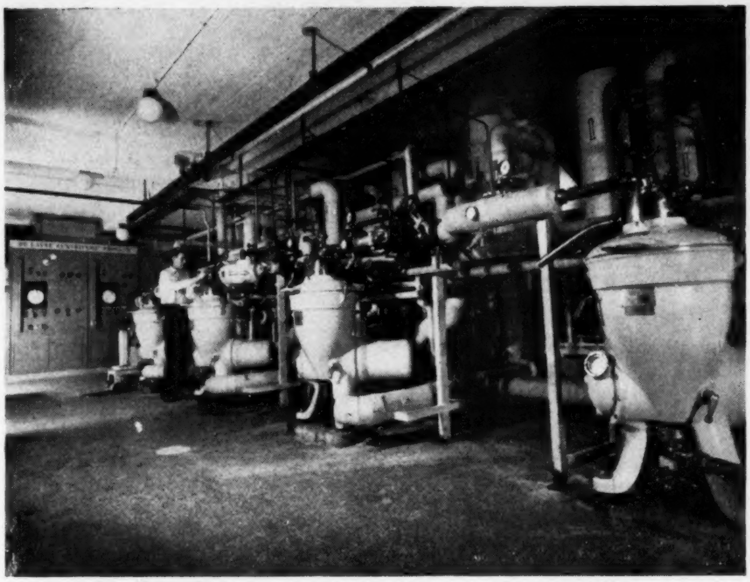
Centrifugal methods for the recovery of wax and oil from rice bran is suggested as the result of a laboratory investigation,[124] and the effect of additives was studied in relation to centrifugal refining of rice oil.[125] Kamela fat is extracted from the seeds with a soft oil and centrifuged after cooling,[126, 127] and a digest of groundnut cake is centrifuged to give fat-free protein.[128]

Numerous patents relating to centrifuges in this field have appeared; extraction procedures include multistage centrifugal systems,[129, 130] a centrifugal solvent extractor,[131] wax from miscella produced from rice bran,[132] cocoa butter and aqueous flavouring



This contactor or solvent extractor, capacity 90,000 gal./hr., is used for mixing, separating, washing, clarifying, neutralising, decolourising, acid treating, chemical reacting, and solvent extractions requiring 1 to 15 countercurrent stages. Makers are Podbielniak Inc. in the United States.

* Part 1 appeared in the November issue and covered practical and theoretical studies, new machines, countercurrent extraction, separation of petroleum products, etc.



An installation showing four hermetic centrifuges, type TVG 40974H, as used in the new De Laval 'Centripure' continuous soap process.

agents from cocoa beans,[133] and oil from a cream produced by centrifuging emulsions prepared from oil seeds.[134, 135] Refining techniques are covered by hydration,[136] caustic soda refining,[137] two-stage alkali refining,[138] dehydration and rehydration of soda ash/oil mixtures,[139] addition of emulsion breaking agents,[140] addition of inorganic acids and salts or weak acids in a two-stage process,[141] ammonia refining,[142] addition of phosphoric acid to reduce refining losses,[143, 144] addition of sulphuric acid to eliminate unwanted products[145] and the separation of fatty acids from hydrolised soapstock.[146]

Animal fat products

There is increasing interest in continuous processes for animal fat production and two reviews[147, 148] give information and make comparisons between modern continuous fat-rendering processes employing centrifuges; these include the Chayen, Kingan, Sharples and Titan systems. Among the latest developments is the new De Laval *Centriflow* process;[149] this employs a two-stage continuous centrifuging procedure involving a primary separation of the disintegrated raw material using a horizontal conveying-type machine. The fat from this machine still contains finer types of solid which are separated in a second centrifuge, which is of the intermittent solid discharging type. The process is stated to be very simple to operate and gives an exceptionally high yield of fat of first-class quality, due to the very short processing time. Further references include the centrifugal separation of soaps and wash water in the production of interesterified lard[150, 151] and fat recovery from disintegrated fatty tissue after heating.[152, 153] Stearic acid is centrifugally separated after controlled crystallisation of crude fats[154] and tallow fatty acids are emulsified with water and separated into two phases.[155]

Two references[156, 157] give information on the separation of oil in the processing of fish and a patent[158] covers a process for oil recovery from fish livers.

Soap

A washing and finishing treatment of saponified kettle soap using Podbielniak contactors has been suggested.[159] Some advantages would be gained in inefficient plants, but in modern systems employing countercurrent washing procedures, these would appear to be not so great. Some further general details of the Sharples continuous process have been published[160] and American capital and processing costs for a 20 tons/day plant of this type are quoted.[161] Application and advantages of centrifuges to various operations in the batch production of soap have been reviewed.[162, 163] Continuous centrifugal soap processes have been receiving attention over many years, but invariably certain disadvantages were inherent in these systems.

Recently, details of a further new process have been released which overcomes these disadvantages in what is described as a revolutionary manner.[164, 165] Known as the De Laval *Centripure* process, it is completely and automatically controlled throughout its totally enclosed system, and makes use of a most ingenious principle for adjustment of operating conditions based on a constant composition control. There are three basic separation steps involving centrifuges, these being the separation of salted-out soap in the first machine, followed by a reseparation in the second machine after further washing and, finally, after adding further electrolyte, fitted neat soap is separated from nigre. As with other similar systems, countercurrent washing is employed to give high glycerol content spent lyes. The centrifuges employed are of the hermetic type and these appear to possess considerable advantages over open-type machines for such a system.

The recovery of glycerol is an important aspect of soap-making processes and centrifuges are universally employed for the separation of the salt from the evaporated lyes. The various types employed are dealt with in an article by Ziels,[166] from which it appears screen and solid-bowl types similar to the Bird machine are most common.

Sugar

In this application where basket centrifuges play such a vital rôle it is only natural that attention is paid to their development and improvement. Stuhlreyer[167, 168] has described the features and operation of 48 in. × 30 in. Western States' automatic continuous batch centrifugals. Some problems associated with the continuous push-type have been reviewed[169] and the designs adopted to reduce the packing effect are considered; once this is achieved the rotational speed can be reduced, which results in a reduction of crystal damage, one of the most serious drawbacks of the earlier continuous machines. The *Hydromat* is another continuous machine.[170] It is a cone-screen type in which the massecuite is directed to the basket bottom which consists of a small accelerator portion with solid, slightly tapered walls. The screen part of the basket spreads out above this and the crystals form into a thin layer due to their increasing speed. Some data for the machine is compared with that for a Broadbent centrifugal, but it is incomplete. Further performance details of the

Escher Wyss model C4 continuous push-type machine in this industry have been given.[171]

A most comprehensive catalogue[172] gives details of the various Broadbent machines and auxiliary equipment which have been developed specifically for this industry. The various types of commercial continuous centrifugals which are available are reviewed by Gaessler,[173] the development of centrifugals is described by Belsey[174] and passing reference is made to cane sugar separation.[175] It has been pointed out by Pidoux[176] that molasses is not only residual syrup, but also fine sugar crystals which have passed through the mesh of the basket. A method adopted to minimise this loss in centrifugals with poorly fitting sieves consists in fitting retaining hoops at the top and bottom of the gauze.[177]

A number of reports on centrifugal performance at specific factories are recorded. These include the operation of 23 Broadbent machines at Sezela, South Africa;[178] Watson Laidlaw machines at Wonji, Ethiopia;[179] Western States' machines at Lieusaint, France;[180] six high-speed machines at Malinagar, India;[181] and a comparison between low-speed and high-speed centrifugals at La Carlota, Philippines.[182] A further report of interest[183] concerns the operation of two Cail continuous machines on low product massecuites and white sugar. For the low-product material the machine speed was 2,800 r.p.m. and gave almost comparable quality products with those from batch machines, but sugar was contaminated by drips of uncentrifuged massecuite. For white sugar two machines were used in parallel and the combined product fed to a single machine for washing. Agglomerates and lumps caused by drips of the feed spoiled otherwise white and brilliant sugar; it is considered a modified basket would overcome the contamination in these operations.

Various attempts have been made to apply high-speed centrifuges to clarifying procedures in this industry. A 6,000-r.p.m. Merco machine has been used for separating soil, sand, etc., from cane juice.[184] The machine operated at capacities of up to 1,800 gal./hr. and removed up to 75% of the suspended solids. Erosion was a serious problem and the use of such machines was judged to be uneconomic for routine use. Evaporator syrup has been clarified using a Westfalia large sludge space clarifier of 10 tons/hr. capacity.[185] The purity slightly increased, but effectiveness of colloid removal could not be determined due to insufficient centrifuge capacity. Dyke[186] has presented a paper covering test work with a De Laval recirculating-type nozzle machine for clarification of first carbonation beet juice. Capacities of over 7,000 gal./hr. are recorded and, although the juice was not as clear as that from a Dorr clarifier, it was free from inorganic solids and lighter in colour. The sludge discharge from the centrifuge filtered and washed exceedingly well on vacuum filters. Similar work is reported from Russia[187] and developments are continuing. A three-stage countercurrent washing of clarifier scums for sugar recovery is suggested[188] following tests with a De Laval AC/VO nozzle machine. Centrifugal clarification of 65° Brix cane juice improves boiling and sugar quality[189] and limed cane juice was clarified using a Sharples *Super* centrifuge in laboratory investigations into a double clarification process.[190]

There is a growing interest in sugar products as a source of chemicals and a variety of centrifuges are used in the recovery of dicalcium magnesium aconitate from molasses.[191] Initially a pilot plant employed a 14-in. solid basket. For the full-scale plant the first recovery is in the form of a concentrated slurry using a De Laval nozzle machine. The slurry is then charged to a 40-in. Bird solid basket machine for molasses removal, and the crystals are then washed and finally recovered using a Sharples *Super-D-Canter*. A similar machine is occasionally used in parallel to the basket machine when the latter is operating at maximum output. Further investigations on a laboratory scale into three alternative methods of producing this material made extensive use of a 12-in. bottle-type centrifuge.[192] Itaconic acid is also recovered and purified using a 40-in. stainless-steel automatic suspended batch centrifugal.[193] A further report[194] indicates that six separate centrifuging operations are carried out in the production of monosodium glutamate from beet sugar filtrates. The process involves hydrolising the filtrates and precipitating potassium sulphate which is separated using a continuous centrifugal, in two operations. The liquor from the first separation is evaporated to precipitate further potassium sulphate which is centrifuged off. The liquor is then cooled and stored to crystallise out crude glutamic acid which is filtered off, washed, and centrifugally recovered. The crystals are then dissolved in alkali and the acid reprecipitated by hydrochloric acid addition followed by centrifugal recovery. The crystals are then dissolved in caustic soda and evaporated when the monosodium glutamate is crystallised out and recovered by a further centrifuge. In patented processes, sugar is centrifugally recovered after pressure extraction using an ammoniated organic solvent[195] and insoluble salts are centrifuged out during molasses purification.[196]

A specialised form of the well-known laboratory 'Super-Centrifuge,' operating at 50,000 r.p.m., is used to spin the raw egg fluid used in the vaccine manufacturing programme. This separates the virus from the culture medium, and the purified virus forms the basis of the vaccine. The very high centrifugal force—62,000 × G—plays an important part in obtaining good separation. Sharples Centrifuges Ltd. are the makers of this unit.

Patents covering machines specifically designed for this industry include a three-cage push type with washing and drying devices,[197] a similar type in which the cages are concentric, thereby shortening the length of the machine,[198] a horizontal-cone type fitted with three different screens and pneumatic throughput control,[199] a cone type with inner and middle cones

for distributing magma and purging molasses followed by washing in the outer cone, all cones being independently rotatable,[200] and a bowl type, single or multi-stage, with perforated bands and provision for countercurrent washing.[201] Auxiliaries for equipment of this type include stabilising devices to reduce vibration and gyration,[202] a control mechanism for sugar washing[203] and devices for assisting sugar discharge by subjecting the basket to shocks etc.[204]

Two reports on the selection of motor drives for machines in this industry have been published.[205, 206]

Chemicals

In a paper by Kelsey[207] various continuous screen and solid-bowl centrifuges are described with particular reference to the coal and coke industries. It covers in some detail their application for dewatering fine coal and ammonium sulphate separation and indicates the limitations and some results to be expected from the machines under consideration.

In the recovery of uranium from phosphate rock,[208] two Sharples *Nozljector* machines are used for the counter-current extraction of the material using a solvent solution of an organic phosphate ester. Further on in the process a uranium tetrafluoride complex is recovered using a solid-bowl Tolhurst machine fitted with internal rings.

Traces of plant waxes present in chlorophyllin solutions are removed using a Sharples *Super* centrifuge.[209] In the production of tetracycline and chlorotetracycline[210] the mesh solids after extraction and washing are centrifuged; crude chlorotetracycline crystals are recovered and purified in a two-stage centrifuging operation. Part of this is reprocessed to give tetracyline and this likewise involves a double centrifuging procedure. A further report on the production of this material[211] refers to a Sharples *Super-D-Canter* for separating a solvent/mycelia slurry to give a 60% solvent content sludge. A *Dynocone* machine is used for the separation and washing of ammonium sulphate crystals[212] and a Bird machine is used to concentrate lime mud from 30 to 61% dry solids.[213]

References to basket centrifuges in the fine chemical field include the separation of *Terramycin* hydrochloride crystals using a Broadbent machine,[214] centrifuging nitrofurazone slurry in a rubber-covered centre-slung basket,[215] the recovery of urea,[216] and a two-stage separation and purification of *p*-xylene using stainless-steel Baker Perkins machines.[217] A two-stage separation process is also applied to the production of lithium hydroxide crystals,[218, 219] and potassium tantalum fluoride crystals for the production of tantalum are separated in a rubber-covered suspended Tolhurst machine.[220]

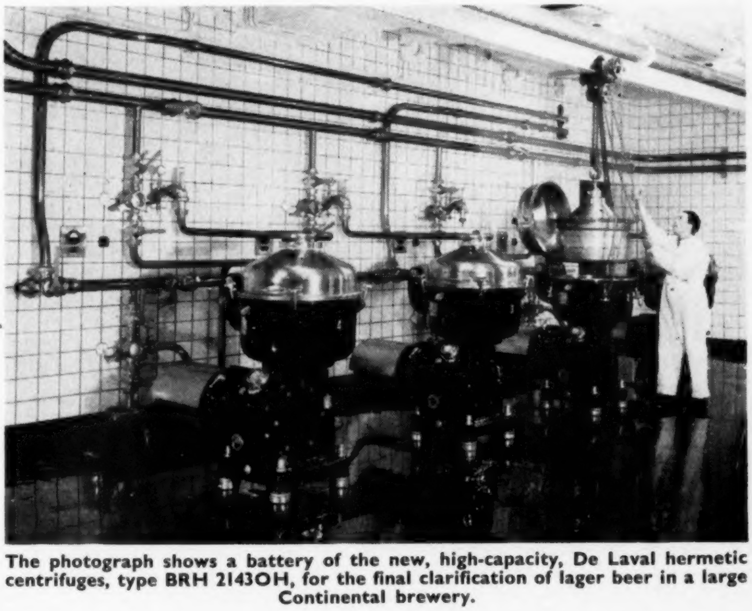
In the heavy chemical field, ammonium perchlorate crystals are recovered by centrifuging, reslurried and dried in a flash drier centrifuge. Liquor from the first separation is evaporated; sodium chloride which crystallises is centrifuged out, prior to liquor recirculation.[221] Ferrous chloride crystals are removed by centrifuging in a sulphuric acid recovery process from waste pickling liquors.[222] Passing reference has been made to the separation of the double salt of potassium magnesium sulphate,[223] borax,[224] ammonium nitrate crystals,[225] diammonium phosphate crystals,[226] coarse salt from brine[227] and sodium carbonate crystals.[228]

Other industries

Brewing. Vacano[229] has published a most interesting review of the principles of centrifugal separation with particular reference to the types of solid and liquor encountered in this field. The characteristics of the various centrifuges used are also included. The centrifugal separation of 'trub' from hot wort is dealt with and it is shown that considerable advantages are obtained, particularly in wort recovery and overall beer quality. The latter is also dealt with in a similar manner in a further report[230] describing the application of large sludge space solid-bowl centrifuges for this duty; the advantages of this type are compared with the results to be expected with nozzle and intermittent solid discharging centrifuges. Another review of beer clarification methods includes centrifuging procedures.[231]

Reference has already been made to the new De Laval hermetic clarifier type BRH 21430[37] and some of these are now in operation in a large European brewery, clarifying lager at capacities of 3,300 gal./hr./machine.[232, 233] In the production of yeast extract, centrifuges are used for washing and separating the yeast.[234] Operating data and the economics of treating wine lees using a Titan centrifuge are reported.[235, 236] A patent[237] covers a method of centrifugally clarifying malt liquors or beer.

Fruit juice. The operation and advantages of centrifugal clarification of fruit juices is summarised by Hartmann.[238] A second contribution by the same author[239] covers preparation of fruit juice concentrates by freezing and the subsequent centrifugal separation of sugars and aromatic substances. A further report[240] covers the centrifugal removal of coagulated sediment in the treatment of stored fruit juice. Repeated centrifugal purification of crude orange oil to remove aqueous and solid matter followed by a final centrifugal dewaxing process at −18°C. is referred to in an article by Schweisheimer.[241] The pressed juice of the West Indian cherry is centrifugally clarified.[242]



The photograph shows a battery of the new, high-capacity, De Laval hermetic centrifuges, type BRH 2143OH, for the final clarification of lager beer in a large Continental brewery.

Starch. Considerable developments have taken place in this industry during the last decade, particularly in the manner in which starch is separated from gluten. Formerly large areas known as 'tables' were used for this separation by gravity and controlled flow. In any modern factory of any size these tables have been entirely superseded by centrifuges specially developed for this duty. An interesting account of one of the latest conversions to such a system has been published.[243] In this plant a three-stage countercurrent washing of maize starch is practised using De Laval TX 2937 centrifuges (*q.v.*[37]). Each machine is fitted with an automatic gravity controller for the separated starch so that the operation of this system and final quality of the starch is rigidly controlled. Three other De Laval recirculating-type nozzle machines are also employed; two for recovering traces of impure starch which is recycled to the main system, and one for concentrating the gluten recovered by one of these machines. In this way complete recovery and superior separation of the two products is ensured. The concentration of maize gluten also forms the subject of another report.[244] In this, several different nozzle-type separators are described and the practice of nozzle discharge recirculation to increase the concentration of gluten to give protein values greater than 70% is dealt with. A further article[245] describes the advantages of centrifuges over tables for wheat starch manufacture, and in particular the possibilities of fractionating the starch into two parts of different grain size. The continuous two-stage centrifugal separation of wheat starch in Australia has also been described;[246] in this instance the starch recovered has a final albumen content of 0.2% and is free from fibre. Merco centrifuges are also applied to this industry, and brief details of a two-stage process for wheat starch have been published.[247] The first stage employs two 8,000-gal./hr. centrifuges rotating at 2,200 r.p.m. in which the starch is washed to some extent and the starch from these two machines is rewashed in a second machine rotating at 2,050 r.p.m. The overflow from the first two machines is concentrated in four 6,000-r.p.m. centrifuges, and the products recovered then go on to further processing. A patent[248] covers the preparation of water-soluble starch from farina after treatment with calcium chloride solution and centrifugal separation.

Wool scouring. The centrifugal recovery of wool grease from wool scouring liquors has been common practice for many years. Recently there has been a revival of interest in an old method of froth flotation of the grease prior to centrifuging, and a report on this process has been published[249] together with a patent covering similar methods.[250] Two further reports suggest adjusting the liquors to *p*H 8 to 12 with alkali so as to centrifugally recover neutral wool grease;[251, 252] a patent[253] covers the addition of surface-active agents to give easy grease recovery by repeated centrifuging and a further patent[254] covers a process for treating the liquors prior to centrifuging.

Dairying. A continuous butter-making process employs a concentrator centrifuge to increase the fat content of cream to 82% prior to processing into butter,[255] and it is reported[256] that the centrifugal separation of cream followed by dilution and re-separation gives a 99.5% pure fat. Patents cover a continuous butter process with a centrifuge to concentrate the fat,[257] a two-stage centrifugal separation of butterfat from milk to give higher solids with the fat,[258] and the design of a cream separator to give effective separation at 40°F.[259]

Other applications. Passing reference is made to the centrifugal separation and washing of protein for the production of *Ardil* fibre,[260] gamma globulin produced from centrifugally separated blood plasma,[261] blood separation in the recovery of products therefrom,[262] clarifiers and hydro-extractors in laundries and dry-cleaning works,[263] solvent clarification in the washing of small precision parts,[264] dehydration of water-gas tar using a Sharples *Nozljector*,[265] the cleaning of paper stock by vacuum deaeration and centrifuging,[266] and various centrifuges are suggested for the production of mannitol and laminarine from seaweed.[267]

Patented processes and machines include beeswax recovery,[268] particle size distribution using a centrifuge bowl fitted with different paper or metal zones,[269] the separation of bleaching earth from oils and fats using a flushing liquid countercurrent to the sludge flow,[270] similarly, for the same operation the centrifuge is provided with two sets of rotors,[271] a centrifuge design for the separation of liquids having a sticky lighter component[272] and a centrifuge with ring valve for sludge discharge.[273]

Auxiliaries

A useful cone-shaped feeder for basket machines assures peak performance and prevents unbalanced loads;[274] automatic control for Fletcher vertical batch-type machines is now available;[275] and a new nozzle by Merco has flow passages designed to improve flow efficiency.[276]

Patents in this sphere cover: foam prevention from nozzle centrifuges by air displacement with steam;[277] heating basket centrifuges;[278] basket charging apparatus;[279] air or pneumatic operation loading controls,[280, 281] bottom discharge valve,[282] discharge shoes,[283, 284] discharge mechanisms,[285, 286] cover closing mechanism,[287] driving means and methods,[288, 289] and a centrifugal braking and control apparatus.[290]

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British Standards

Copper cyanide for electroplating (B.S. 2884: 1957, 4s. 6d. net). This is the ninth publication in the series 'Materials for electroplating.' The standard specifies the chemical composition of the copper cyanide, and the amount of permissible impurities. Appendices lay down methods of determining copper, cyanide, iron, chloride and insoluble matter. After pointing out the highly poisonous nature of copper cyanide, an appendix to the standard gives advice on its handling. It lists the symptoms of hydrocyanic acid and cyanide poisoning, and follows this with four 'first-aid' instructions.

Copper sulphate for electroplating (B.S. 2867: 1957, 3s.). Requirements are specified for chemical composition of the crystals, and the extent of the permissible impurities is laid down. The tests (for which procedures are described in detail) are for the determination of copper, nickel, iron, arsenic, insoluble matter and chlorides.

Manholes (B.S. 470: 1957, 3s., 'Manhole and inspection openings for chemical plant'). The Factories Act, 1937, incorporated the requirements for manhole openings specified in the first edition of B.S. 470, which was issued 25 years ago. Now the standard has been revised to deal with manhole openings, hand holes and inspection holes for chemical plant and for mobile tanks for chemicals.

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European Free Trade —Change will be Gradual

says Mr. G. N. Hodson, M.B.E.

(Chairman, British Chemical Plant Manufacturers' Association)

FAR more chemical engineering research of high quality goes on in Britain than the apologists would have us believe, declared Mr. Hodson in a speech at the Annual Dinner of the British Chemical Plant Manufacturers, held in London recently. He pointed out that the B.C.P.M.A. had always enjoyed close collaboration with the Association of British Chemical Manufacturers, but nowhere has it been closer than in the field of chemical engineering research and the exchange of non-confidential technical information.

Increased capital investment in chemicals

Referring to the chemical plant industry as the suppliers to a ' virile and expanding industry,' Mr. Hodson pointed out that the best yardstick to its progress was the capital expenditure of its principal customers. Capital investment in this industry rose from £33 million in 1948 to over £100 million in 1956, and in the period 1948-56 totalled over £600 million. Future plans reported show continued expansion and in petroleum chemicals alone it is expected that the total capital investment of £55 million in 1955 will have been doubled by the end of 1958.

Competition in Europe

On the subject of the European Free Trade Area, Mr. Hodson remarked that reactions to this vary not only from industry to industry but from firm to firm within an industry. It must be remembered, however, that the change will be gradual. His personal opinion was that the result would be to help the strong, the quick-witted and the hard-working, whilst the weak, the ordinary and the idle will have even more reason than usual to complain of life's inequalities. Competition will be keener as will the opportunities be greater, but it was expected of the Government that it should create a climate in which the competition met with was *fair*, conditions of exporting were *not* inferior to those of neighbours, industry was allowed to keep enough of its earnings to re-equip its factories, and a little more than lip-service was paid to the problem of inflation. The Government should appreciate that whether the Free Trade Area idea turns out to be a boon or a disaster depends as much on them as it does on industry.

Later in his speech Mr. Hodson said the B.C.P.M.A. was glad that the Institution of Chemical Engineers had joined the European Federation of Chemical Engineering and the Association was most gratified by the recent election of its director, Dr. E. H. T. Hoblyn, M.B.E., as a vice-president of the Institution, and to know that he is to be actively concerned with its work within the European Federation.

Guests

Mr. Hodson's speech was made in proposing the toast of ' The Guests ' and among those who were connected with points made in his speech were Sir Hugh Beaver, K.B.E., president of the Federation of British Industries and of the Institution of Chemical Engineers; Mr. B. Hickson and Mr. George Brearley, chairman and director, respectively, of the Association of British Chemical Manufacturers; Mr. C. F. Dutton, president of the Association of Tar Distillers; Mr. D. L. Walker, C.B.E., general secretary of the F.B.I.; Mr. A. W. Berry, director of the British Engineers' Association; Mr. S. C. Bishop, M.B.E., to whom Mr. Hodson made special reference, since, after being responsible at the Ministry of Supply and the Board of Trade fo. the affairs of the chemical plant industry for over 10 years, he was shortly to retire; Mr. W. B. Draper, chairman of the Food Machinery Association; Mr. H. A. R. Binney, C.B., director of the British Standards Institution, and Mr. Thorne, chairman of the Council of British Manufacturers of Petroleum Equipment.

One representative of the learned societies present was Mr. Julian M. Leonard, immediate past-president of the Society of Chemical Industry, while a member of the B.C.P.M.A.'s own Council, Mr. R. F. Stewart, was ' guest in his own house ' as chairman of the Chemical Engineering Group of the Society. Dr. J. B. Brennan, general secretary of the Institution of Chemical Engineers, was also present.

Among those whose unavoidable absence was regretted were Sir Leonard Owen, of the United Kingdom Atomic Energy Authority at Risely; Mr. G. V. Sims, director of the Council of British Manufacturers of Petroleum Equipment; Dr. Kerfoot, president of the Association of British Pharmaceutical Industry; Mr. C. C. Last, chairman of the British Plastics Federation; and Mr. Allen, chairman of the Nuclear Energy Trade Association's Conference. Altogether, official and private guests at the dinner numbered some 300, the total attendance being about 650.

Meeting in London

There are Opportunities for British 'Know-how' Overseas

says Sir Hugh Beaver, K.B.E.

(President of the Federation of British Industries, President of the Institution of Chemical Engineers)

EXPORTS of chemical plant was among the topics touched upon by Sir Hugh Beaver in responding, as the principal guest, to Mr. Hodson's toast. He said he had been informed that these exports have been running, over the first nine months of the present year, at a somewhat higher rate. That, if maintained, was satisfactory, but it was realised that much of the plant manufacturers' overseas work, namely the provision of *services* in one form or another, did not show in these export statistics. This, of course, was one of the ways in which Britain operated most profitably abroad, and Sir Hugh said that he had been interested to find that what the Chinese Technical and Economic Delegation had been most interested to learn during their visit to Britain was how British 'know-how' can be linked to their industrialisation plans. He had no doubt that B.C.P.M.A. members had already been in touch with the Liaison Office that had been set up by the Sino-British Trade Council.

Export opportunities in India and Canada

There had also been talks with the delegation representing industry in India, which had visited Britain. There was a very genuine feeling there, he said, that this country should and would play a big part.

Sir Hugh also referred to the impending visit of the large and very important delegation from Canada. At present, although we took one-sixth of Canada's exports, we sent only one-tenth of Canada's imports. He believed it would be found that they were coming with a very clear direction from their own Government to exploit all the means of increasing trade between the two countries.

Overseas opportunities were largely pipe dreams unless there was a firm basis at home, Sir Hugh said. Are we going to have industrial peace ? Are we going to have stable prices ? Are we going to hold the pound, and our balance-of-payments position ? The solution lay primarily with the Government, but not wholly. We cannot attack the *total* Government bill but insist that there should be no reduction in this direction or that where it particularly concerned us. We must be realistic and we must be honest.

European Free Trade

On this subject Sir Hugh said that the interchanges of views that had been going on were, as far as one could see, bringing discussions nearer to the crucial points. It was, of course, easier *not* to prophesy, but he himself thought that, largely for political reasons and because this was an evolution that present conditions were forcing, we should have a free trade arrangement in one form or another. Sir Hugh believed, further, that this would be a good thing, provided always that it is not made impossible for British industry to compete either by action by other Governments or by its own Government. He believed that, where doubts existed, it was more on this score than on any others.

Sir Hugh supposed it was generally felt that, whereas *we* should keep any bargain whether in the end it suited us or not, other parties would not be so scrupulous. In fact, it might have sometimes seemed to us in these latter years that we have been over-generous and over-optimistic in our actions towards others, with little recompense.

B.C.P.M.A. and chemical engineering

Sir Hugh referred to the close and happy relation that has existed over the years between the B.C.P.M.A. and the Institution of Chemical Engineers. It was close because the two organisations operated in the same fields.

On a personal note, Sir Hugh remarked that he was an old friend of many of those present, and he paid tribute to one whose name was in the Association's report last year and who was his hard-working, loyal and most efficient ally on the Air Pollution Committee—Dr. Foxwell. Sir Hugh stressed the value of Dr. Foxwell's contribution to the air pollution work.

Methanol and formaldehyde

Head Wrightson Processes Ltd., London, have announced an agreement with Inventa A.G., of Lucerne, Switzerland, enabling the British company to design and supply plants to the Inventa processes for the production of methanol and formaldehyde in the U.K. and British Commonwealth (excluding Canada).

The technical and design information on the production of methanol from carbon monoxide and hydrogen which Inventa will pass to Head Wrightson under this agreement is based on the experience of running an industrial-scale plant at the works of an associate company in Switzerland over the past 15 years. A highly important feature of this process is the special catalyst employed.

Advances in Low-temperature Gas Separation in Industry

Many developments of great practical significance in this field were discussed at a symposium on 'Recent Developments in Industrial Low-temperature Gas Separation,' organised jointly by the Institution of Chemical Engineers and the Low Temperature Group (The Physical Society) in London on November 26. Among other matters, interest in capital and operating costs emerged strongly, as the following abstracts show.

Power saving in low-temperature gas separation

In low-temperature gas separation the desire to reduce power consumption arises not only because of its direct effect in reducing operating costs but also because it will normally result in a reduction in the capital cost of compressors and their prime movers and services which may even lead to a net decrease in the capital cost of the complete plant. After pointing out this incentive to low power consumption, Dr. G. G. Haselden, PH.D., D.I.C., A.C.G.I., A.M.I.CHEM.E. (Imperial College, London), went on to discuss methods of saving power. Air separation was selected as a suitable process for detailed study, but most of the points raised were of general significance.

After a comparison of existing methods of approaching ideal conditions in an air separation column a new cycle is proposed, employing a non-adiabatic distillation column. It is pointed out that with energy considerations occupying so vital a place in low-temperature columns design it would seem profitable to introduce new design concepts. The column would be considered as a device in which the potential energy of the descending liquid and the energy released by the vapour, as a result of pressure drop, were employed to the best possible advantage to produce mixing and intermixing of the two phases. With this in mind the various modes of contact of liquid and vapour could be analysed to see which leads to the greatest rate of mass transfer for the minimum consumption of energy.

For duties involving partial condensation or evaporation the conventional wetted-wall column is seldom adequate. A new type of distillation device, termed *Over-flow* packing, is being developed for this duty. It consists of a corrugated packing suitable for incorporation in the brazed plate-type heat exchanger. Preliminary tests with this packing on mixtures such as benzene-acetone show values of H.T.U. of about 3 in. combined with very high condensing-film heat-transfer coefficients. The methods of forming headers used with plate-type exchangers enable units to be constructed in which two fractionating systems could interchange heat, or in which one fractionating system could interchange heat with one or more flowing liquid or vapour streams.

The factors affecting efficiency in tonnage oxygen plant, namely irreversibilities of distillation and expansion, heat exchange losses, heat inleak and fluid friction, apply with equal force in all multi-component separations. A new problem arises, however, in choosing the optimum arrangement of columns for effecting a required separation. This question was discussed in relation to cracker-gas separation, although the approach used is of general validity.

In concluding his paper Dr. Haselden remarked that for all gas separation processes involving low-temperature distillation it is possible to propose theoretical operating cycles which would require only the thermodynamic minimum power requirement. The skill of the designer of a practical plant is reflected in the extent to which he is able to approach ideal operation whilst maintaining high rates of transfer in a plant of minimum complication. This will involve eliminating all unnecessary sources of irreversibility and establishing a right balance of those which remain. In low-temperature distillation it appears that an overall efficiency of between 15% and 25% should be possible, depending on the mixture to be separated.

Producing oxygen for industry

In the United States new techniques for the design and construction of air separation plants are constantly coming to light and the economies of large-scale installations have made large quantities of oxygen available as an inexpensive, high-purity chemical. Some of the latest developments and problems of the oxygen supplier were discussed by Mr. M. A. Dubs, Linde Co., Division of Union Carbide Corporation. He explained that an oxygen supply system consists of the usual apparatus for separating air, and additional equipment for storing and delivering oxygen on demand to meet peak loads, provide stand-by, and improve the economy of operation. A system was briefly described in which automatic control makes it possible to achieve unattended operation and therefore lower costs. This description did not apply to those large-tonnage oxygen plants where demand is relatively steady, absolute continuity of supply is not required and lower-purity oxygen is permissible.

Basic cycles for the modern air separation plant still depend on thermodynamics rather than on automatic control and integrated supply systems, and safety is also a vital factor. Considerable emphasis is laid on package design to reduce field labour and decrease costs, while an important feature of the modern air separation plant is its heat and mass transfer equipment. Among modern developments are the use of low-cost, extended surface heat exchangers and the modern version of the tonnage plant regenerators. In the field of separating columns, Mr. Dubs

states, sieve trays are still preferred to bubble caps for low-temperature service. Hydraulic losses remain an important factor in tray design, especially in the larger tray sizes.

Another important feature of the typical modern plant is instrumentation, and in an unattended plant instruments of great reliability are called for. Even if only a few instruments with much less than 100% reliability are used, the overall reliability of the plant will be low. The basic philosophy in instrumentation is to provide the minimum necessary to operate and control the process and to regulate oxygen production according to demand. In addition, critical process variables must be monitored as a safety measure and to protect equipment in the case of malfunction.

Proper insulation often determines plant performance and recent plants use an expanded *Perlite* with a packed density of some 10 lb./cu. ft. Where materials of construction for low-temperature equipment are concerned, various metals are being used and aluminium has come into particularly extensive use in the United States in recent years. Some welding problems have been overcome.

New trends in gas separation

With the expansion of the petrochemicals industry, the separation of the normally gaseous hydrocarbons has become of increasing importance. At present, low-temperature fractionation predominates because of its satisfactory performance and its economic operation. To handle the problem of large gas separation plants and varying gas compositions, attention has been devoted to plants employing normal petroleum refining practices, particularly with respect to mechanical engineering of the plants. In such plants all the fractionating towers are located on foundations on open ground with no limitations imposed on plant size. Heat exchangers are similarly located either in an open steel structure or on foundations near the ground. All equipment is constructed for accessibility and ease of maintenance. Refrigerants are treated as utilities like cooling water. They are compressed and liquefied at a central point and distributed to the various coolers and condensers throughout the plant.

These points were included in a paper by Mr. C. C. King, M.S.CH.E., of the Chemical Process Division, M. W. Kellogg Co., U.S., who, in discussing the various fractionating steps and the factors influencing design, pointed out that the demethanising operation, being the most difficult and costly step in the entire separation process, has been the subject of more variations than any other. An indication of this is the fact that demethanisers have been constructed for operating pressures from 50 to 550 p.s.i. The reason for this is concerned with the low-temperature requirement of this step and the vapour-liquid equilibrium of the methane-ethylene system. Mr. King pointed out certain disadvantages of the auto-refrigeration system and stated that increased refrigeration can be obtained from this system by using an expander engine in place of the Joule-Thomson expansion. Many ethylene plants have been built using Joule-Thomson expansion for the lowest temperature refrigeration and only a few plants have employed expander engines. However, at least one large ethylene plant now under construction in the U.S. will employ an expander engine on the demethaniser.

A great many ethylene plants of the low-temperature-separation type have already been constructed and these plants have mostly used shell-and-tube heat exchangers which, states Mr. King, are expensive in the demethaniser system when constructed of stainless steel. In the U.S. at least one manufacturer is offering to the industry a special type of heat exchanger which in low-temperature service often results in large savings in capital cost, particularly if full advantage is taken of the potential reduction in plant refrigeration requirements.

The refrigeration system is a most important feature of a low-temperature separation plant and in a study made under Gulf Coast, U.S., conditions comparing a four-level ethylene refrigeration system with a two-level system it was found that the four-level system had an investment cost advantage of \$0.20/annual ton of ethylene product in addition to an operating cost advantage of \$0.25/ton of ethylene.

An alternative type of refrigeration system could be used to replace the methane system consisting of a vapour compression and expansion system such as is used in air liquefaction.

Olefin recovery

The recovery of high-purity olefins from light hydrocarbon mixtures by low-temperature fractionation was discussed in a paper by Mr. L. B. Baker, B.SC., M.SC. (Badger & Sons Ltd.). He pointed out that in Western Europe the recent trend has been for large olefin recovery plants to be closely integrated with the plants converting the olefins into various chemical products and intermediates such as polythene, ethyl alcohol, *iso*-propyl alcohol, and propylene polymers. These plants require uninterrupted olefin supplies of constant quality and to meet this need the olefin recovery plant must be capable of continuous operation for long periods or adequate storage capacity for the olefins must be provided to cover temporary stoppages. A low-temperature storage system for ethylene of sufficient capacity to meet several days' demand is very costly and olefin recovery plants are described which have been designed to ensure stable operation over very long periods without periodic shutdowns for cleaning and maintenance.

The compressors may be reciprocating or centrifugal. In small plants centrifugal machines cannot be employed, owing to the need to deliver a certain minimum volume of gas from the last wheel of the compressor, while for large installations economic considerations often dictate the choice. Comparable costs for a United States' installation have been published and it has been pointed out that utility costs and availability are deciding factors.

After briefly discussing some considerations involved in the chemical treatment of the compressed gases and in drying, Mr. Baker went on to deal at some length with fractionation problems and also pointed out that acetylene removal facilities are an important feature of low-temperature olefin recovery units and exert a significant influence on their design. Two principal methods are currently practised on an industrial scale: solvent washing at low temperature and selective hydrogenation.

Production of high-purity and medium-purity oxygen

Special problems arise in the design of tonnage oxygen plants, as there is at present a shift from medium- to high-purity oxygen, while at the same time the consumption rate fluctuates in many cases. Generally the problem of the designer is to find for a given set of conditions the best combination of power consumption and capital costs, while labour costs are relatively unimportant in very large plants.

A process is available which in its latest development is claimed to meet these conditions. It produces simultaneously and at high purity gaseous and liquid oxygen in

proportions which can be varied over a wide range, while being also suitable for the production of gaseous oxygen only at high or medium purity. Extra cold production and other important functions are achieved at high efficiency by compressing a small and variable proportion of the air to a high pressure and subsequently expanding it isentropically.

In view of the use of a single column, the operating pressures of the main air streams are lower than in other known air separation processes and this, it is stated, increases notably the degree of purification of the air to be separated, resulting in high utilisation and safety factors of the plant.

A full description of the *Rescol* process was given by Dr. P. M. Schuftan, DR.PHIL., M.I.CHEM.E., and A. G. Mackie, B.SC., D.R.T.C., emphasising particular design features and showing the layout of the plant. The authors, both of British Oxygen Engineering Ltd., presented operating data and operating costs for the *Rescol* process for the scale range between 100 and 300 tonnes/day of oxygen.

Purifying hydrogen before distillation

In a paper by W. H. Denton, B.SC., F.INST.P., B. Shaw, M.SC., TECH., PH.D., and D. E. Ward, B.SC., PH.D., all of the Atomic Energy Research Association, Harwell, methods are discussed for purifying hydrogen prior to distillation to 20°Kelvin in a plant for the large-scale separation of deuterium. Particular attention is given to ensuring continuous re-evaporation of solid deposits from the feed gas heat exchangers, especially in the range 63°K. to 20°K. where high deposition rates of solid nitrogen can occur.

A general theory is given for the operation of reversing exchangers for this duty, which, taken in conjunction with the appropriate solid-vapour phase equilibria, gives the limiting maximum operating temperature differences. It is shown that for hydrogen there will be supersaturation and/or formation of solid fog particles in the gas stream with possible adverse consequences.

A purification system is described consisting mainly of reversing heat exchangers, and despite the much greater degree of supersaturation of impurities in hydrogen than in air, experiments show that the reversing heat exchanger principle can be used for the continuous purification of hydrogen down to 80°K., containing CO_2, provided that suitably phased reversing valves are used to reduce gas flow surges.

Solid particles appear in the gas stream but only during an initial equilibrium period when they are filterable. In the higher concentration regions solid deposits are loose and mechanical blowing-off is responsible for the removal of an appreciable part of the solid.

Bearing in mind that the present experimental heat exchangers are empty tubes which offer little resistance to the carrying down of solid particles to the lower temperature levels, since the total solid accumulation rate is no more than 10 p.p.m. out of a 0.4% CO_2 feed, the prospects of developing reversing exchangers or ribbon packed regenerators for the successful low temperature purification of hydrogen appear to be good; although the high solid deposition rates occurring with an ammonia synthesis gas feed will present special problems. Suitable types of fin geometrics in plate-fin units or crimped ribbons in regenerators may be necessary to trap solid fog particles.

Although theoretical considerations show that high Reynolds numbers do not overcome supersaturation tendencies, which depend principally on the physical properties of the gas mixture, turbulent flow may assist in driving solid particles towards the surfaces. Mechanical obstruction of the particles by suitable heat exchanger surfaces would probably be much more effective.

The complete inversion of the solid-vapour phase equilibria on approaching 20°K. rules out the use of reversing exchangers in this region, and this presents a problem not present in air separation plant. It is interesting that there is a natural compensation for this in that in this temperature region the specific heats of constructional metals are very low, well into the Debye T^3 region, so as to allow heat exchangers to be warmed up periodically without imposing unduly high refrigeration loads on a working plant.

Electronic computors as an aid to low-temperature plant design

Recent developments of electronic computers have opened a whole new field of possibilities for chemical plant design, the most publicised results being obtained with giant computers, such as E.N.I.A.C., applied to nuclear energy problems, and this has probably left the impression that electronic computer aid is beyond the reach of the average design department. That this is not so is illustrated by a paper given by Dr. R. W. H. Sargent, PH.D., D.I.C., A.M.I.CHEM.E., of Societe l'Air Liquide, Paris, in which he described the applications of a computer in the design of low-temperature plant.

The computer is one of the newer standard types, primarily designed for routine accounting, and Dr. Sargent's paper was chiefly concerned with a computer-tabulator combination in which both data and programme instructions are fed into the tabulator in the form of punched cards, the results being printed on a roll of paper. The use of the computer in low-temperature plant design was illustrated by examples involving the three most common problems: flash equilibrium, plate-to-plate calculation of columns and multi-channel heat-exchanger calculation.

From various considerations discussed in the paper it appears that the design department must be organised to make possible the regrouping of calculations in order to treat series of the same type together. With a little experience, the designer learns to arrange the sequence of design so as to co-ordinate his own work with that of the machine so that he is rarely held up for results from the computer. In the very early stages of plant estimation and planning, to give a prospective customer a preliminary estimate, there is made available sufficiently detailed data to obtain a good cost estimate, an idea of the plant layout, and an exact figure of power consumption.

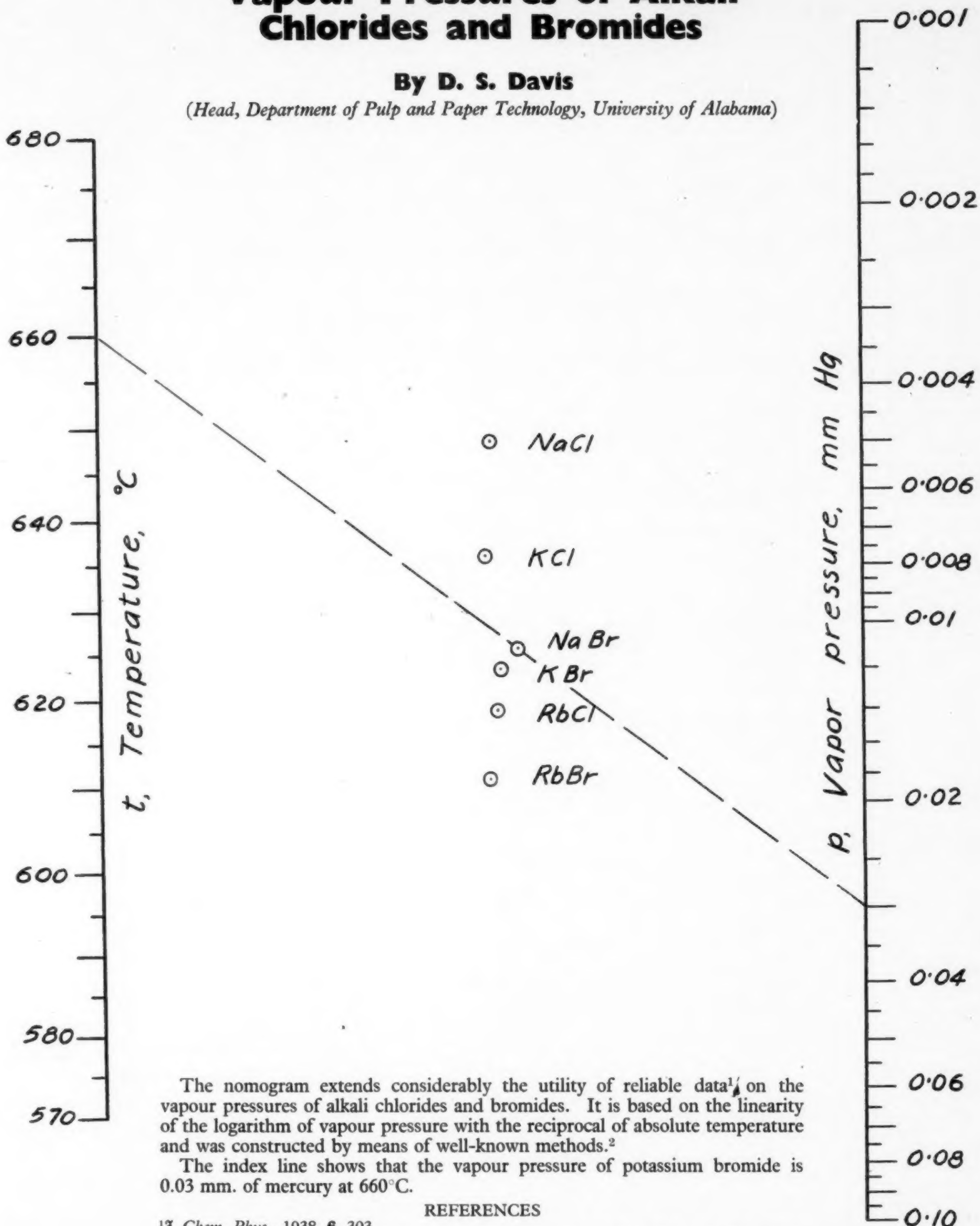
Whereas the paper discusses application of a computer with 15 'memories,' the author reveals that his company has recently acquired a newer model equipped with extra storage in the form of a magnetic drum. This machine contains effectively 8,250 memories, in which either data or programme instructions can be stored. It is possible with this machine to treat each problem more completely.

Nomogram:

Vapour Pressures of Alkali Chlorides and Bromides

By D. S. Davis

(Head, Department of Pulp and Paper Technology, University of Alabama)



The nomogram extends considerably the utility of reliable data[1] on the vapour pressures of alkali chlorides and bromides. It is based on the linearity of the logarithm of vapour pressure with the reciprocal of absolute temperature and was constructed by means of well-known methods.[2]

The index line shows that the vapour pressure of potassium bromide is 0.03 mm. of mercury at 660°C.

REFERENCES

[1] *J. Chem. Phys.*, 1938, **6**, 303.

[2] D. S. Davis, ' Nomography and Empirical Equations,' Chapter 10. Reinhold Publishing Corporation, New York, 1955.

Company News

Recent announcements by Imperial Chemical Industries Ltd. concerning its interests in the fields of heavy organic chemicals, polythene and copper tubes reveal the following:

Organic chemicals. The continuing growth in size and complexity of I.C.I.'s Billingham Division has led to the creation of a new Heavy Organic Chemicals Division. The chairman of the new Division will be Dr. S. W. Saunders, at present a managing director of the Billingham Division.

Polythene. In view of the rapid growth of its polythene business, Imperial Chemical Industries Ltd. has decided to bring all aspects of its polythene work under unified control. All responsibility for production, research and development, together with the assets and staff employed in the production of *Alkathene*, I.C.I.'s brand of polythene, will be transferred from I.C.I.'s Alkali Division, in whose laboratories polythene was discovered, to the Plastics Division.

Copper tubes. Yorkshire Copper Works Ltd. and Imperial Chemical Industries Ltd. are exploring methods of combining their activities in the copper and copper alloy tube and plate industry in a joint enterprise on the basis of equal participation. I.C.I. would contribute its new copper tube factory at Kirkby, Liverpool, which is one of the most advanced in the world, the Allen Everitt copper and copper alloy tube works at Smethwick, Staffs, the plate factory at the Landore Works, South Wales, and the Fyffe fittings factory at Dundee.

Yorkshire Copper Works Ltd. would contribute its large copper and copper alloy tube and fittings works at Leeds, together with its recently established manufacture of plastic tubes; also the tube factory at Barrhead in Scotland, the shell moulding works at Castleford known as Anson Units Ltd., and the controlling interest in Yorkshire Fittings (Australia) Pty. Ltd.

★

A new company, Petrochem GmbH., has been formed in Dortmund, Germany, by Birwelco Ltd., to manufacture *Iso-Flow* fluid heating furnaces to the design of Petro-Chem Development Co. Inc., New York.

The new company has received its first order, which is from Esso A.G., of Hamburg, for its new refinery at Cologne. It is for seven furnaces, including one of 85 million B.Th.U./hr.

The laboratory of the development and research department of the Mond Nickel Co. Ltd. celebrated its 21st anniversary recently.

The laboratory, which is situated in Birmingham, was opened in 1936. It has been responsible for the development of many new nickel alloys. The members of the laboratory have also played an important part in the development of spheroidal graphite cast iron, and in addition they have contributed many papers on the various theoretical aspects of metals, particularly transformations in special alloy steels.

★

For their works at Eaglescliffe, near Stockton-on-Tees, British Chrome & Chemicals Ltd. have placed an order with the Power-Gas Corporation Ltd. for a new sulphuric acid plant with an output of 100 tons/day in the form of 95% and 70% strengths. Elemental sulphur will be the raw material. This plant will be built to the design of Chemiebau Dr. A. Zieren GmbH., who co-operate with Power-Gas for the installation of sulphuric acid plants in the United Kingdom and abroad.

★

The new extension to the factory premises of Joshua Hindle & Sons Ltd., valve manufacturers, will lead eventually to the doubling of equipment output. The extension will be almost exclusively devoted to production.

★

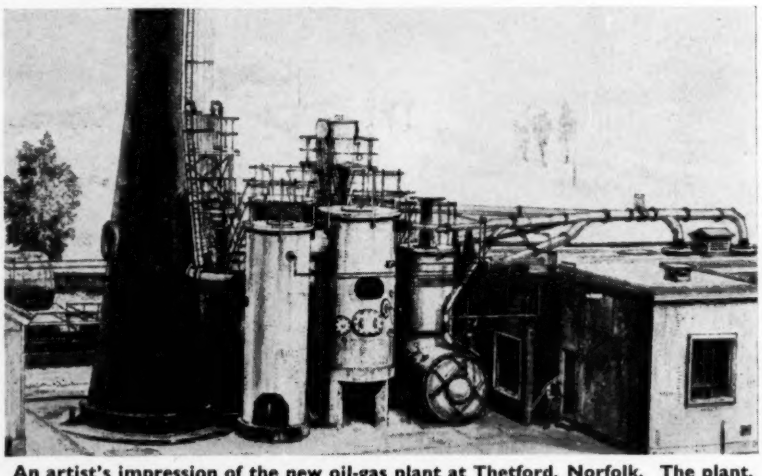
Marchon Products Ltd., of Whitehaven, Cumberland, have modified their representation in Australia. John Beith & Co. Pty. Ltd., with headquarters in Sydney and offices in Melbourne and Brisbane, will continue to handle *Nansa* and *Empicol* products—alkyl aryl sulphonates and fatty alcohol sulphates—and Marchon's associated company, Albright & Wilson (Australia) Pty. Ltd., of Melbourne, who also have offices in Sydney, will be responsible for all other Marchon products sold in Australia.

★

To meet a constantly increasing demand for I.C.I. paints, considerable extensions have recently been made to the Paints Division factory at Slough. Now a programme of expansion and reorganisation, to be completed by 1961, is being started shortly at the company's Stowmarket works in Suffolk. The main increase in production will be met by a complete reorganisation of existing machinery and handling methods. A new plant, being designed by the Paints Division and embodying the latest developments for efficiency of working and safety, is to be installed on the site and a further 21 acres are to be developed.

★

Partial occupation of the new 180,000 sq. ft. Permali Ltd. factory at Gloucester has now released more space in the existing works to expand manufacture of PTFE products. This plastic material is sold under the newly registered name of *Permaflon*, which is claimed to have complete resistance to most chemicals between a working temperature range of –80°C. to 250°C.



An artist's impression of the new oil-gas plant at Thetford, Norfolk. The plant, built by Humphreys & Glasgow Ltd. for the Eastern Gas Board, makes Thetford and its neighbour, Brandon, the first towns in Britain to have a gas supply entirely produced from oil.

Technology Notebook

Fuel technology and nuclear energy

The Institute of Fuel is the latest body to be admitted to membership of the British Nuclear Energy Conference. The constituent societies of the B.N.E.C. now number eight.

Instrumentation and computation

The Institution of Chemical Engineers, the Society of Instrument Technology and the British Computer Society are jointly organising a symposium on 'Instrumentation and Computation in Process Development and Plant Design,' which will be held in London in the summer of 1959.

Enquiries should be sent to the Institution of Chemical Engineers, at 16 Belgrave Square, London, S.W.1.

Women in engineering

A report published recently by the Women's Engineering Society is based on the conference held at Coventry earlier this year to enable representatives of education, the Youth Employment Service, industry and women engineers to meet and discuss the opportunities available for the woman engineer and technologist and the problems still to be solved in her training and employment. The full text of the speeches and discussion is included, together with the closing address by the Right Hon. Iain Macleod, Minister of Labour and National Service.

Copies are available from the Society at 25 Foubert's Place, London, W.1, price 15s.

Cobalt progress

At the second general meeting of the Cobalt Development Institute it was decided that the research work on cobalt utilisation, undertaken this year, should be further developed in 1958. This work, commissioned with specialised organisations in Belgium and abroad, includes basic research and studies of a more immediately practical character aimed at extending the field of application of cobalt.

The Cobalt Development Institute is a technical and scientific organisation, members of which are the world's major cobalt producers. Its object is to expand, in all countries, the existing uses of cobalt and to search for new ones. It has no commercial activity.

Scholarship

The Sheffield steel firm of Edgar Allen & Co. Ltd. have offered to establish a postgraduate research scholarship at Sheffield University in such subjects as metallurgy, chemistry and engineering.

The University Council accepted the offer of the scholarship, which will be known as the Charles Kingston Everitt memorial scholarship, in memory of a former chairman of the company.

INDUSTRY REPORTS . . .

Fisons report continuing expansion

A rise in the index of raw materials costs for fertiliser manufacture was commented on by Sir Clavering Fison in his review of the affairs of Fisons Ltd. Although the change was a much smaller one than has been experienced in any of the last four years, he said, it masked some rather violent changes and does not fully reflect the impact of certain circumstances surrounding the chief material, phosphate rock. Anxieties regarding phosphate rock due to political changes in North Africa led the company to take measures which, on the scale that was necessary to give a satisfactory degree of insurance, were very costly.

All the Fisons' fertiliser factories worked again at full pressure throughout the year. A new compound granulation unit at Plymouth was successfully commissioned early in the year. Production of triple superphosphate at the Immingham factory reached a new record, and additional plant is being installed there. Work has begun at a new nitrogen factory at Mucking, on Thames Side, and initial production should commence in the autumn of 1958.

Referring to the success of hydrazine as a raw material, Sir Clavering mentioned that a new and larger plant embodying improved production features is in the last stages of construction, and is expected to be in production early in 1958.

Aluminium

Among the important matters covered in the annual statement of the chairman of the Tube Investments Ltd., Sir Ivan A. R. Stedeford, K.B.E., is an agreement with the Reynolds Metals Group of America and the formation of a new company—Reynolds T. I. Aluminium Ltd.—with a nominal capital to be held in equal proportions by T. I. and Reynolds Metals. This company has taken over the T. I. aluminium fabricating businesses, the South Wales Aluminium Co. Ltd., Reynolds Light Alloys Ltd., and T. I. Aluminium Ltd.

Sir Ivan noted that Reynolds Metals are at present the largest producers of primary aluminium in the United States, and are still expanding, with a reduction capacity of over 700,000 tons a year of virgin metal planned by 1960. Possessing resources of over £200 million, they operate extensive plants for the manufacture of sheet, extrusions, tubes and fabricated parts, and are the world's largest manufacturers of aluminium foil.

More competition in fertilisers and industrial chemicals

Mounting competition in home and overseas markets for fertilisers and industrial chemicals was referred to by I.C.I. Billingham Division chairman, Mr. W. J. V. Ward, after presenting his half-yearly review recently. However, the review showed continuing high production with new output records.

Referring to competition in the home market for fertilisers, Mr. Ward expressed confidence in the ability of the I.C.I. products to stand up to this competition and emphasised the importance of maintaining high standards of quality.

Turning to industrial chemicals, Mr. Ward spoke of continued good sales of methanol urea and formaldehyde to the plastics industry and of record sales of *Drikold*.

He said Billingham was making regular bulk deliveries of liquid carbon dioxide to the Atomic Energy Authority at Calder Hall and was in fact supplying them with a large share of

their annual requirements. Other customers were also showing interest in the bulk delivery of liquid carbon dioxide. Billingham was also establishing a business in bulk liquid argon and several customers were using its product.

Mr. Ward emphasised that competition in overseas markets for industrial chemicals was mounting. 'We are having to fight hard to maintain our place,' he said. 'As in the fertiliser market, quality, service and price are of the utmost importance and the type and cost of packages in which products are delivered is beginning to matter more and more.'

He spoke of continuing sales of Billingham urea in the United States despite rapidly increasing production in the United States itself and of close attention being given to the possible effect on urea sales to Canada as a result of plans for a manufacturing plant there.

Oil and coal processing

In their annual review the oil and coal processing and extracting firm of Deutsche Erdöl-Aktiengesellschaft, of Hamburg, state that expansion of the processing plant to achieve an annual throughput of 1.5 million tons of crude oil will be completed by the end of 1958. A platforming plant for reforming the primary gasoline from the distillation plant, and a desulphurisation plant for diesel oil are also due to be completed.

D.E.A.'s crude oil is mainly processed in its refinery at Heide (Holstein) which, in addition to the usual distillation plant, is composed of a catalytic cracker as well as of installations for the urea dewaxing process and for the separation of pure ethylene.

The company's lubricating oil refinery at Hamburg-Grasbrook is one of the biggest in the Federal Republic.

'AND NOW, LADIES AND GENTLEMEN, FOR THE CHRISTMAS DRAW'

World News

VENEZUELA

Big oil refinery expansion

Each the first of its kind to be built in Venezuela, a new catalytic cracker and a new alkylation plant have been officially inaugurated at Cardón refinery on the Paraguaná peninsula. With a capacity of 33,000 bbl./calendar day, the cat cracker will enable high-octane gasoline necessary for the modern high-compression engine to be produced in larger quantities. The alkylation plant, with an initial design capacity of 1,400 bbl./calendar day, will enable the highest quality aviation gasoline to be produced from 100% indigenous materials.

Also under construction at this refinery, operated by Compañía Shell de Venezuela, is the fourth distillation unit, which will raise Cardón's total capacity to approximately 300,000 bbl./calendar day, making it the most complete major refinery in Venezuela and one of the largest in Latin America. The total cost of these three plants will be almost £30 million.

Another recent development at Cardón was the completion in August this year of the 180-mile-long, 20-in., high-pressure gas line, which starts from the La Paz/Concepción area west of the town of Maracaibo. This enables natural gas to be used for the operation of the refinery, replacing the liquid fuel previously used for this purpose and making it available for sale.

This year saw the 40th anniversary of Shell's refining activities in Venezuela which commenced in the San Lorenzo refinery on the east shore of Lake Maracaibo in August 1917.

GREAT BRITAIN

Carbonylation alcohols

Imperial Chemical Industries Ltd. are to extend their capacity for the manufacture of carbonylation alcohols by installing a third unit at Billingham. This unit will produce an additional 20,000 tons p.a. of carbonylation products, the main outlet for which is in plasticiser manufacture. The first unit was started up in 1951, and the second early in 1957. It is expected that the new unit will be in operation by the middle of 1959.

INDIA

Chemical by-products

A number of industrial products will be available to the country as by-products when three steel plants go into production. At Rourkela provision has been made for producing light oil, carbolic oil, naphthalene oil, wash oil, anthracene oil and pitch.

In addition, the adoption of the oxygen blowing process (l.d. process) for making steel in Rourkela will result in large quantities of nitrogen being available as a by-product. Making use of this and of the hydrogen from the coke-oven gases, it is proposed to produce 440,000 tons of fertilisers-nitro-limestone.

In Bhilai, the by-products produced will be ammonia sulphate, benzole, toluene, xylene, solvent-naphtha, phenol oil, naphthalene oil, absorption oil, anthracene oil, naphthalene, crude anthracene, crude phenols and pitch. In Durgapur, the by-products which are expected to be available for sale are ammonia sulphate, benzene, toluene, xylene, solvent-naphtha, naphthalene, road tars and creosote.

RHODESIAS AND NYASALAND

Metal mining developments

Nickel. The nickel deposits at Bindura, on which the Rhodesian Vanadium Corporation took an option, proved much less promising than anticipated and the Corporation relinquished its option. The subsequent discovery of a large new deposit in the area has, however, revived financial interest. This new deposit is said to be similar to the one now being brought into production in Manitoba.

Uranium. Anglo American Rhodesian Mineral Exploration Ltd. has applied for exclusive rights to seek and mine uranium over a 25-sq.-mile area about 60 miles east of Livingstone, near the western end of the lake which will be formed when the Kariba dam is completed.

Titanium. A deposit of titanium in the Port Herald district of Nyasaland is being investigated and is reported to show considerable promise.

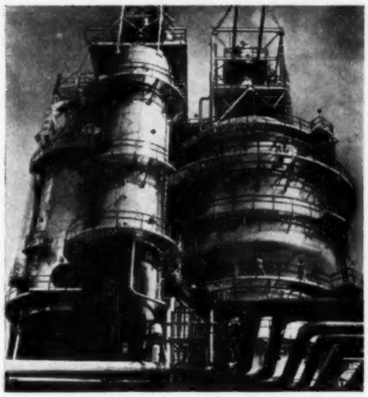
Castor oil

Rhodesian Castor Industries Ltd. are to erect a pilot plant for the extraction of oil from castor seed at Cwelo. Initially about 40,000 to 50,000 tons of seed will be processed annually, but provision will be made to expand to a capacity of 250,000 tons p.a.

JAPAN

Middle East resources development

It has been announced that the Japanese Government has decided to



View of the new catalytic cracking plant at Cardón Refinery, Venezuela.

extend financial and technical support to Japanese firms which might engage in oil exploitation projects in Saudi Arabia and Iran.

Petrochemicals

The Showa Petrochemical Co. has been formally inaugurated in Tokyo. The company will build a plant on reclaimed land at Kawasaki for the production of polythene and ammonium sulphate. Technical assistance for the manufacture of polythene is to be obtained from the Philips Petroleum Co. of the U.S.

CEYLON

Manufacture of antibiotics

A U.K. and a Danish concern (Glaxo Ltd. and Dumex Ltd., respectively) are building and equipping factories in Ceylon for the manufacture of antibiotics, other drugs and invalid foods. Following representations made to the Ceylon Government by the two concerns, the duty on a wide range of goods and equipment imported for use in such local manufacture was reduced.

MEXICO

Titanium dioxide

Industrias Quimicas Basicas de Mexico S.A. is to build a titanium dioxide plant in the state of Vera Cruz with a capacity of 8,000 tons p.a. Nacional Financiera are participating by guaranteeing credits for the supply of plant and by direct investment. The process and technical assistance is being bought from the Glidden Co. of the U.S.

Hydrofluoric acid

Fluoro Mex S.A. have begun production of anhydrous hydrofluoric acid near Mexico City. The sole client will be Pemex, who use the acid as a catalyst in the production of aviation gasoline and additives.

SOUTH AFRICA

Urea plant

An £800,000 order placed with British Oxygen Linde Ltd. for a plant at Modderfontein, near Johannesburg, will provide an extension of the African Explosive & Chemical Industries ammonia plant. The plant will be used for the manufacture of urea.

African Explosives recently announced that it would undertake a £10-million expansion of its nitrogen manufacturing capacity at Modderfontein.

CANADA

Continuous tar distillation plant

Dominion Tar & Chemical Co. Ltd. are to construct a continuous tar distillation plant at Hamilton, Ontario. When completed during the summer of 1958, the new unit will process 15 million Imp. gal. p.a. of tar to produce solvent, tar acid oil, naphthalene oil, creosote and pitch products.

PAKISTAN

Sulphuric acid plant

A sulphuric acid plant at the Karnafuli paper mills in East Pakistan went into production recently. The plant, first of its kind in the province, has a capacity of 10 tons/day of commercial-grade sulphuric acid with a purity of 98%. The chemical, mostly used by tanneries, was previously imported from abroad or West Pakistan.

As present East Pakistan requirements are below the capacity of the plant, it is proposed to convert the surplus into aluminium sulphate which is required in considerable quantities by the Karnafuli Paper Mills.

Another sulphuric acid plant in Lyallpur (West Pakistan) has been in production for the past three years. A 6,000-tons-p.a. superphosphate plant was recently attached to it. Both plants are now working to full capacity.

Fertiliser factory

The Pakistan Development Corporation has signed an agreement with the Kobe Steel Works of Japan for setting up a fertiliser factory in East Pakistan. The factory will produce 106,000 tons p.a. of urea which will give 250 tons of standard fertilisers in terms of ammonium sulphate.

An earlier announcement revealed that another factory is being set up in West Pakistan. The Kobe Steel Works will train Pakistanis as managers, engineers and chemists. The factory will work on natural gas in the Sylhet area.

COLOMBIA

Mining industries

According to a decree published recently other Colombian extractive industries will be subject to the same conditions as the petroleum industry, in that for a period of 30 years they will not be taxed in any way on exports of their products.

NORWAY

Biggest aluminium factory in Europe

Two aluminium works in Western Norway—Årdal and Sunndal, both controlled by the Norwegian State—

MEETINGS

Institution of Chemical Engineers

December 11. ' Models for Piping Design and Construction,' by M. K. Brown and E. Holmes, 6.30 p.m., Midland Institute, Paradise Street, Birmingham.

December 17. ' Chemical Engineering Aspects of Gas-solid Reactions," by Prof. K. G. Denbigh, 7 p.m., Reynolds Hall, College of Science and Technology, Manchester.

Institute of Fuel

December 11. ' Gas Producers,' by S. Gaskill, 2.30 p.m., Engineers' Club, Albert Square, Manchester.

December 11. ' Some Aspects with Regard to Treatment of Boiler Feedwater and Cooling Waters,' by G. T. Peat, 2.30 p.m., Royal Victoria Hotel, Sheffield.

Institute of Metals

December 11. ' Properties of Castings,' by F. Hudson (joint meeting with the London Branch of the Institute of British Foundrymen), 7.30 p.m., Constitutional Club, Northumberland Avenue, London.

December 11. ' Stress - corrosion Cracking," by T. P. Hoar, 7.15 p.m., Cleveland Scientific and Technical Institution, Corporation Road, Middlesbrough.

December 12. ' Titanium,' by J. W. Rodgers, 7 p.m., 9 The Temple, Dale Street, Liverpool.

Incorporated Plant Engineers

December 11. ' Mechanical Handling,' by A. E. Holmes, 7 p.m., Sherwood Room, County Hotel, Theatre Square, Nottingham.

have decided to increase their production to 150,000 tons p.a., thus reaching a greater total production than any other factory in Western Europe today. When the aluminium works in Mosjöen in Northern Norway—now under construction—is completed, it will produce 90,000 tons p.a. The Norwegian part in the world production of aluminium will then increase from 3% to 4%.

Norsk Hydro, the big nitrogen-producing concern, has hitherto been the leading Norwegian industrial undertaking with an annual production to the value of £20 million.

Titanium

The mining of the large deposits of ilmenite by A/S Titan in the Jossingfjord area are to be extended. The annual production has already reached 200,000 tons of ilmenite concentrate. When the new installations are ready in 1960 the production will be doubled.

The Leonard Hill Technical Group—December

Articles appearing in some of our associate journals this month include:

Corrosion Technology—Protection of Concrete Against Corrosion; Corrosion Problems in Fuming Nitric Acid; Rusting and Its Cost to Farming; Protection Achievement at Manvers Main Colliery; Further Report on the Corrosion Convention.

Petroleum—Lothian Oil Shale Industry; The Future of Oil Shale; Corrosion and the Petroleum Industry; Solvents for Petroleum; Canadian Catalyst Factory; Mobiloils New Laboratory; Expansion of the Clarkson Refinery.

Dairy Engineering—Looking Back on Olympia, Impressions of the 71st Dairy Show; Pumps for the Dairy Industry; Survey of Pumps; Mechanised Crating Cycle.

Food Manufacture—The Treatment and Disposal of Factory Water; Radiation Processing of Foods, 2; The Evolution of Container Closures.

Automation Progress—Review of Interkama; Gauge - Controlled Grinders in Germany; Simplification and Standardisation; Continuous Car Engine Testing; Transfer Press Assembles Car Wheels; The Analytical Approach; Automatic Control of Photographic Print Exposure; Modern Punched-Card Equipment.

World Crops—The Value of Legumes in Crop Associations in the Tropics; The Quality of Tea, 1; Rice, 1; The Problem of Tillage in Sugar-Cane; The Termite, 2.

Fibres—American Research on an Improved Fungicidal Cotton Fabric Coating; Recent Progress in the Production of Fibre-forming Polyamides; Finishing and Dyeing of "Dynel" Fabrics; New Materials from Cotton Stalks.

Personal Paragraphs

★ The death occurred on October 19, in the British-American Hospital, Madrid, of **Dr. G. F. New,** O.B.E., general manager and secretary of the Fertiliser Manufacturers' Association for the past 12 years. Born October 15, 1894, he was educated at the Simon Langton School, Canterbury, and University College, London. After a short period as lecturer at the East London College, he went to Northern Ireland as chief physicist, Linen Industrial Research Association. From 1927 to 1934 he was at Teddington, Middlesex, as chief physicist, Paint Research Station. In 1934 he was at Billingham, Co. Durham, as development manager, British Titan Products Co. Ltd., and from 1936 to 1938 he was president of the Oil and Colour Chemists' Association. During the war he was seconded to the National Federation of Paint, Colour and Varnish Manufacturers and was concerned with the allocation of raw materials, in particular with the allocation of linseed oil. Among the appointments he held since the war are: general manager and secretary, Fertiliser Manufacturers' Association Ltd. (since 1945); secretary, Fertiliser Society (since 1947); secretary, Superphosphate Manufacturers' Association Ltd. (since 1948); secretary, International Superphosphate Manufacturers' Association (since 1952). In 1956 he was awarded the O.B.E. 'for services to industry' in New Year Honours.

★ **Dr. H. G. Reid,** at present general manager of the recently announced Imperial Chemical Industries £100-million projected Severnside site, will shortly become president and a director of Imperial Chemical Industries (New York) Ltd. He succeeds **Mr. K. W. Palmer** in New York, and Mr. Palmer is returning to the U.K. to become a joint managing director of the newly-formed Heavy Organic Chemicals Division of I.C.I. (see 'Company News' in this issue). Dr. Reid's successor at Severnside will be **Dr. H. S. Hirst,** who is at present the technical department manager of the I.C.I. Billingham Division.

★ **Mr. T. E. Houghton,** a director of I.C.I.'s General Chemicals Division and manager of that Division's power department, has retired from the company's service after more than 41 years' service with the company and its predecessors. He joined the United Alkali Co. Ltd. (later I.C.I.

Dr. H. G. Reid.

(General Chemicals) Ltd.) in 1916 and was transferred to the Castner-Kellner Alkali Co. Ltd. in 1929. In 1948 he was appointed manager of the General Chemicals Division's power department and a General Chemicals Division director in 1952.

★ **Mr. H. Shaw** has been appointed Division technical director of the General Chemicals Division of I.C.I. Ltd. He joined the research department of General Chemicals Division's Castner-Kellner works in 1927, and in 1932 was appointed a deputy manager of the Division's technical service department. In 1942 he was appointed works manager of the Division's Rocksavage works near Runcorn, and in 1946 works manager of Castner-Kellner works.

★ The British Aluminium Co. Ltd. announce that **Mr. P. S. W. Swabey** has been appointed assistant general sales manager.

★ **Prof. E. W. E. Mörath,** who is well known for his work in the field of forest products technology and wood anatomy, has joined the board of International Plastics Ltd. as director of research and development.

★ **Mr. G. W. Powell,** general manager (marine) of Esso Petroleum Co. Ltd., has been appointed a director.

★ **Mr. D. F. Ringe,** formerly chief designer of Vokes Ltd., has been appointed general manager, and **Mr. K. D. Mulcaster,** formerly chief draughtsman, has been appointed to the position of chief designer.

WHAT'S NEWS about

★Plant
★Equipment
★Materials
★Processes

This illustrated report on recent developments is associated with a reader service that is operated free of charge by our Enquiry Bureau. Each item appearing in these pages has a reference number appended to it; to obtain more information, fill in the top postcard attached, giving the appropriate reference number(s), and post the card (no stamp required in the United Kingdom).

Multi-point control valves

Where a number of main control valves are used in the construction of pneumatically or hydraulically operated machinery, the problem of providing interconnecting piping for supply and exhaust connections becomes acute, particularly where space is limited and the pipe size is relatively large. Also, the user is faced with the necessity of expending a great deal of material and labour in providing these interconnections.

A neat and economical solution can be found by grouping the control valves at a central point in such a way that these interconnections are eliminated, and Baldwin Instrument Co. Ltd. have now introduced such a system, in which the valves, which may be fitted with manual, mechanical, electric solenoid or pilot operating mechanisms, are supplied as a multipoint 'packaged unit.' Any number of valves, up to a maximum of 12, can be embodied into a single unit. The supply and exhaust ports of all the valves are led into passages running the full length of the assembly, screwed connections being provided in special end pieces, which also provide facilities for mounting the assembly. **CPE 772**

New alloy resists sulphuric

Improved resistance, at a reasonably low cost, to attack by sulphuric and a number of other acids under those conditions where stainless steel, copper alloys, iron and steel are inadequate is claimed for *Langalloy* 20*v*, an austenitic alloy steel of high nickel and chromium content, containing small amounts of molybdenum and copper. According to the makers, Langley Alloys Ltd., the material has particular applications in the acid treating of mineral oils, certain items of oil refinery equipment and in the dyestuffs, pharmaceutical, petroleum, chemical and acetate rayon industries. Available at present in the cast form, the alloy will be of particular interest for pumps, valves and other fluid control devices, as well as for pipe fittings, nozzles and machine parts where corrosion may be accelerated due to turbulence, aeration or fluid impingement. **CPE 773**

Molten metal pumps

To handle relatively low-melting-point metals such as tin, lead, sodium, etc., and molten inorganic chemicals such as sodium and potassium nitrates and caustic soda, or high-temperature heat-transfer media, two vertical *Mo-pumps* have been developed over the past six years by Rhodes, Brydon & Youatt Ltd. They can be supplied in materials capable of withstanding temperatures up to 850°C.: (*a*) suspended over the liquid on an adjustable joist or (*b*) permanently installed in a cover plate over a vessel containing the liquid. They are available in 1, 1½, 2 and 2½ in. delivery pipe diameter, for heads up to 40 total ft. **CPE 774**

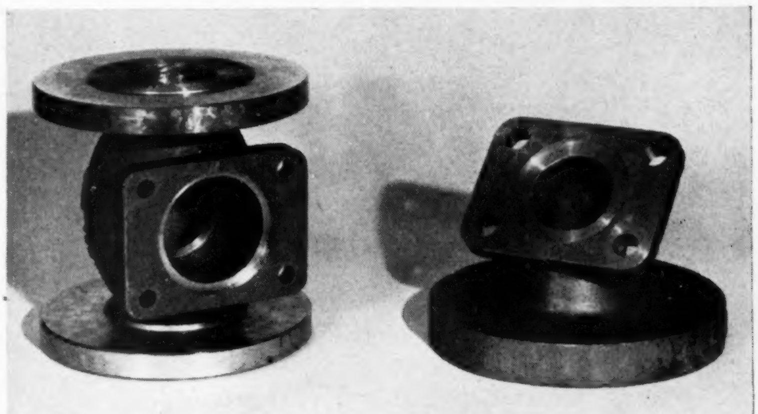
Welding large vessels

For welding thick-walled vessels, such as are used in the refinery, a new electrode, *Fortrex* 35A, has been developed by Murex Welding Processes Ltd. This is stated to give all the required properties in the welded joint with particularly good impact properties at sub-zero temperatures.

With this all-position electrode, slag removal is easy and the radiographic quality of the weld metal is sound, it is stated. **CPE 775**

Resins for rubber manufacture

Styrene/butadiene resins, *Tred* 50 and *Tred* 85, are now available in commercial quantities from a modern



Typical castings in 'Langalloy 20v.'

C.P.E.'S MONTHLY REPORT AND READER SERVICE

plant at the Monsanto Chemicals Ltd. factory at Newport, Monmouthshire. Previously they have been made on pilot-plant scale.

These resins are basic materials for the rubber industry, their main application being in resin rubber, semi-expanded and micro-cellular shoe soling. **CPE 776**

New industrial cleaner

A new cleaner, *Pyroclean* No. 8, is claimed to make possible substantial savings in the cost of cleaning components. The makers, Pyrene Co. Ltd., state that its economy is derived from the extremely low concentration at which it is used. The cleaner, a mild activated alkali powder, can be used in any kind of spray washing machine and cleans both ferrous and non-ferrous metal parts. **CPE 777**

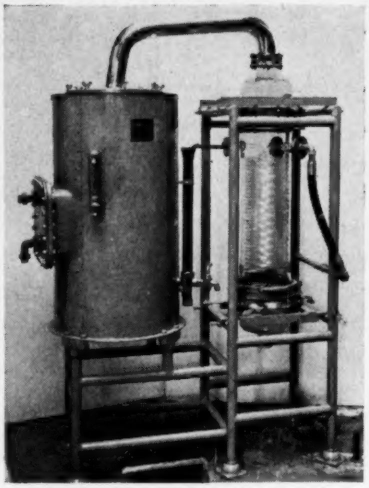
Bound like a book

Known as the *Albion*, a new telescopic post binder has been developed which allows its contents to be opened flat—it looks, in fact, like a book. This makes it particularly suitable for housing catalogues, contract specifications, technical manuals and other publications used in industry and commerce. It is made by C. Cakebread Ltd. **CPE 778**

New design of cooling tower

A new design of *Counterflo* induced-draught cooling tower is being offered by Head Wrightson Processes Ltd. It can be composed of one or a number of cells each equipped with an induction fan which draws the air through the tower from louvre intakes. Water is distributed down the tower from a novel all-timber but totally enclosed distribution system through splash-type grid decks, thus providing a counterflow action.

The tower is constructed of prefabricated timber or concrete units and these factory-made components can be erected on site by unskilled labour teams. **CPE 779**

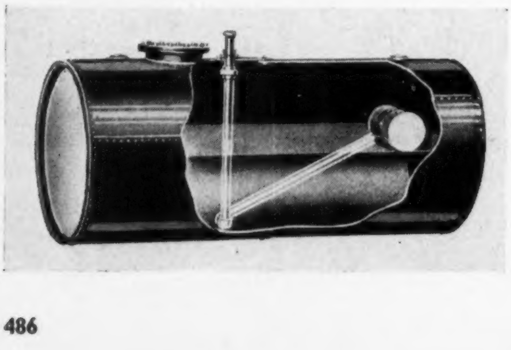


WATER STILL HAS GLASS CONDENSER

The photograph shows a special water still which has recently been supplied to a leading university in Ireland, and which was built with a condenser of glass for the visual observation of the condensing and cooling conditions of the distilled water. The evaporator itself forms part of a standard model water still by Apex Construction Ltd. The feed water is heated in the condenser, discharged to a constant-level device which expels dissolved gases and automatically maintains correct evaporator water level. The still is a hard-water-duty model fitted with a deconcentrator which continuously bleeds off impurities from the evaporator. A steam pressure of 25 *to* 55 *p.s.i. is required and the still has an output of* 10 *gal./hr. at about* 40 *p.s.i.* **CPE 780**

Spray-type wet dedusters

Self-induced, spray-type wet dedusters are now available in 13 standard sizes ranging from 2,000 to 48,000 cu.ft./min. capacity. The deduster, which has been developed by Dallow Lambert & Co. Ltd., is available with four principal methods of sludge removal, being extremely adaptable in this respect. **CPE 781**



Storage tank fitted with 'Bowser' floating suction

Operation recorder

Known as an 'operation recorder,' a new instrument announced by Fielden Electronics Ltd. is described as an extremely versatile instrument which may be used on many varied applications where the recording of events is required. For example, it may be used for registering the on/off times of machines or electrical circuits, for showing the rate at which items are being produced in a repetitive process and for recording the times when vehicles are in a particular area.

The operation recorder is supplied in a die-cast aluminium case with a chart approximately 10 in. in diameter and is designed to operate from a mains supply of 230 v., 50 c/s., single phase. **CPE 782**

Lubricants for atomic power

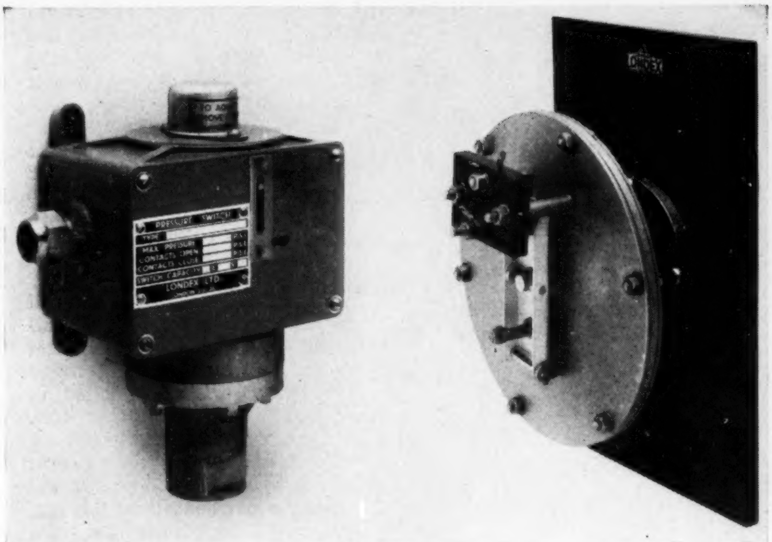
Lubricants to resist the effects of radiation have been developed by C. C. Wakefield & Co. Ltd. Gamma radiation and neutrons can have the effect of thickening lubricating oils to a point at which they are unserviceable, while greases can be similarly affected to produce hard solids. In tests, certain types of petroleum-based lubricants have been shown to resist the thickening effect more strongly than others, while certain materials not of petroleum origin have shown considerable promise. **CPE 783**

Acid-resistant metal

A special metal known as *Nickloy* is claimed to be more resistant to low concentrations of sulphuric acid than F.M.B. stainless steel. Details of the comparison between the two materials are available. A standard range of *Nickloy* cocks are manufactured by the same company, Hunt & Mitton Ltd. **CPE 784**

Floating suction for drawing liquids

The *Bowser* Fig. 280 floating suction now being manufactured under licence by Liquid Systems Ltd. is especially recommended and designed for use in fuelling systems and numerous industrial applications where it is necessary or desirable to draw clear liquid from the surface instead of from the bottom of the storage tank. Its use eliminates much of the trouble caused from the drawing of water or dirt into pump suction lines. The float is permitted to lower as the liquid level falls and to rise when the tank supply is replenished. **CPE 785**



On the left is shown the 'PS/P'-type pressure switch, and on the right the 'POS.'

Pressure switches

Two new types of pressure switches are now being produced by Londex Ltd. The *POS* switch operates on extremely low pressures, it can be used for a variety of applications—if coupled to a rubber tube, it can be used as a limit switch, for vehicle counting, as an alarm device to give warning of persons entering or leaving premises, or for door opening control. The *PS/P* switch is designed for operation on oil hydraulic systems, the build-up of the switch being similar to other standard switches but utilising a piston as the pressure sensitive instead of bellows. **CPE 786**

Vibration measurement

The latest addition to a range of pick-ups is a seismic instrument which can be used to measure the amplitude of torsional oscillation or cyclic variation at the free end of a shaft. It is particularly applicable to internal combustion engine crankshafts and camshafts, machine tool drives and gear boxes.

The pick-up contains a variable-inductance sensing element which detects the angular displacement between the fixing flange of the pick-up and a seismic inertia mounted within the unit. The system contains neither fluid nor springs, a permanent magnet being used to supply both the damping and restoring forces. No rubbing slip-rings are employed to couple the unit to its stationary connecting cable and it can be used on shafts which are merely oscillating as well as on those which are rotating continuously. The pick-up can be calibrated when mounted in its test position. Accurately known sustained angular displacements of the seismic inertia can be made by means of the micrometer fixture provided. This enables an overall static calibration of the recording system to be achieved. Makers are Southern Instruments Oscillograph Division. **CPE 787**

Laboratory mixer

Agitation ranging from a gentle swirling to violent turbulence is obtainable with the *Apex* model L2 *Electrorapid* laboratory mixer, which is fitted with a 1/60 h.p. motor with a no-load maximum speed of 4,500 r.p.m. The mixer has an infinitely variable speed control consisting of a sliding-type resistor fitted in the cast-iron base with the control knob projecting, and is thus protected from dust and liquid.

The motor shaft is double-ended, and at the lower end carries a chromium-plated collet chuck in which is fitted a stainless-steel mixer shaft $\frac{1}{4}$ in. diam. by 12 in. long, with one three-bladed stainless propeller fitted to it. The upper end of the motor shaft carries a three-cone Vee pulley for driving light laboratory apparatus. The mixer is suitable for agitation of volumes up to 5 litres and for an electrical supply of 225 to 250 v. a.c./d.c. Other voltages are available. **CPE 788**

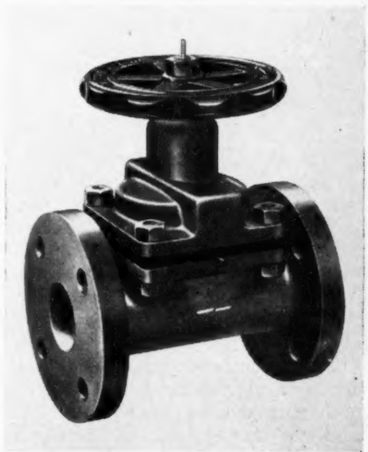
Moisture meter

A high degree of accuracy is claimed for the new Shaw moisture meter, which is stated to be particularly satisfactory on granular fertilisers, etc., and on comparatively large objects such as peas, and also gives accurate results on materials which have recently been dried. The instrument can be used by any unskilled labourer and the moisture is indicated instantaneously on the dial.

The instrument uses very high-frequency electro-magnetic energy, in conjunction with a new circuit. **CPE 789**

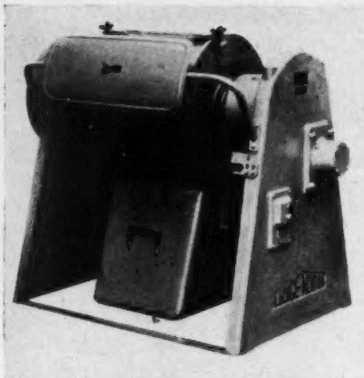
Stationary crane

Powered by a small petrol engine of $2\frac{1}{4}$ h.p. the *Saga Junior* fixed crane will deal with all loads up to 6 cwt. and can raise such loads up to heights of 100 ft. and more. An interesting feature is the provision of three separate hoisting speeds in the transmission, thereby enabling lighter loads to be raised at proportionately higher speeds. **CPE 790**



PLASTIC DIAPHRAGM VALVE

A new range of diaphragm valves has been designed by Warren-Morrison Ltd. to cater for, firstly, the handling of non-corrosive liquids and gases for which the pinch valve might prove too expensive and, secondly, to handle the really difficult applications too severe for rubber. For these applications a PTFE diaphragm and rigid PVC bodies are employed in addition to the normal range of lined metal bodies and synthetic rubber diaphragms. A feature of the valve is that a rising spindle type of position indicator is a standard fitting enabling the position of the valve to be seen at a glance. **CPE 791**



DRY POWDER MIXER

For plasticising plastic powders such as PVC and PVA by the 'dry powder method' or 'dry blend' the Morton Machine Co. Ltd. are marketing the FKM 150 DK *Lödige-Morton mixer. This machine will handle 300 lb./hr. of plasticised powder and, by virtue of its twin barrels, is suitable for discharging continuously directly into the feed hopper of an extruder. These machines are being built under a manufacturing licence from Germany where several firms are in production on this dry powder technique, which obviates the necessity of using mixing mills and calenders.* **CPE 792**

Vessel pump

Safe and convenient handling of the most delicate, dangerous and precious fluids without risk of changes in them due to heating, shearing, contamination or agitation is provided by the Watson-Marlow vessel pump, according to the makers. It incorporates a vessel adapted for both vacuum and pressure, having as part of its structure a patented control device. This device enables it to use air (or inert gas) pressure to generate internal vacuum as well as pressure. It also arranges that when the vessel is under vacuum it is in connection only with the source of the material to be transferred and when under pressure only with its destination. Liquids and slurries, even with large solids, are drawn as smoothly into the vessel as they are expelled from it.

The changeover from one state to the other is effected by moving a single handle a few inches. This operates a simple plug-type switch valve. Apart from this one plug, and then only at the moment of changeover, there are no moving (rotating, sliding, flexing, oscillating, rolling or hinging) parts whatsoever in contact with the fluid.

The two standard materials of construction for all contact parts are F.M.B. or equivalent stainless steel and glass. Other materials or finishes can be specified, say the makers, the Watson-Marlow Air Pump Co.

CPE 793

Electrolytic polishing

An interesting method of preparing specimens for immediate microscopic examination is embodied in an electropolisher in which the electrolyte, drawn through a centrifugal pump, is pumped through a series of holes so that it contacts the specimen as a constantly rotating, continuously renewed liquid column. This ensures a perfect polish and quality finish without flow lines, it is claimed. It eliminates cold working and false deformation structures and reduces specimen preparation to routine instead of the highly skilled operation of mechanical polishing.

Suppliers are Shandon Scientific Co. Ltd. **CPE 794**

New tank-lining technique

For the lining of process and storage tanks with plastic linings of various types, *in situ*, is a new technique which includes the shot blasting of the steel or other surface by a vacuum shot-blasting machine which allows no debris or abrasive to be liberated into the atmosphere; the application of a suitable plastic lining (different types are used depending on the actual duty); and the heat curing of the lining to give a hard, durable, tightly adhering, chemical-resisting and inert film.

Using this technique, it has been found possible in many cases to reline tanks with the minimum of interference with production. For example, it is practicable to reline storage and conditioning tanks in brewery and other cold rooms with a *stoved* lining where the ambient temperature is at freezing point at all times while carrying out the work.

Further details are available from Corrosion Ltd. or from the CPE Enquiry Bureau, quoting: **CPE 796**

POLYGON-SHAPED CRUCIBLES

Baker Platinum Division are marketing a polygon-shaped crucible, which is claimed to possess great stability, versatility and ease of handling.

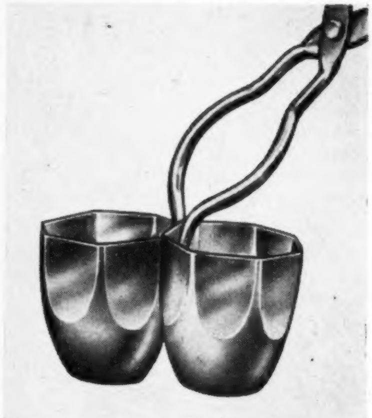
The crucible's flat sides provide a good surface for tongs, thus avoiding the tendency to crimp, and there is always a corner 'spout' opposite each flat side which facilitates easy pouring. A further advantage is that, with these flat sides, two crucibles can be picked up and handled at one time.

CPE 795

Ventilators are safety devices too

Dual-purpose, fusible-link heat and smoke exhaust ventilators, which combine ordinary industrial ventilation systems with a fire venting safety system, were recently exhibited in London by Colt Ventilation Ltd. Each fire vent is operated by ordinary controls for day-to-day requirements, as well as by fusible link, so that the moment the temperature in the roof reaches 158°F.—indicating that a fire has broken out—the link holding the ventilator louvres in position fuses, and the ventilator falls open automatically to release heat and smoke before they can build up and make fire-fighting difficult or impossible.

CPE 797



Tongs holding two polygon-shaped crucibles.

Low-cost humidity control

An inexpensive means of controlling humidity is provided by the *Regeltron* humidistat, a new unit incorporating an electronic relay and costing 15 guineas. The unit is of the visual control type and is produced in a varied range of mountings. It is available with a 3-in. or 4-in. dial fitted with one, two or three sets of non-corrosive potential contacts as required and, according to the makers, its accuracy is such that the R.H. differential is under 1%. Suppliers: Alexander & Tatham Ltd. **CPE 798**

FOR VERY LOW FLOWS

Designed for exceptionally low capacity applications, this Masoneilan *type* 107/108, *diaphragm-operated control valve is claimed to be particularly useful for pilot plant and dosing applications, etc. It has as standard an* 18/8 *stainless-steel Barstock body rated at* 6,000 *p.s.i. with ½-in. female connections which can be screwed B.S.P. or A.P.I. The body is available with alternative size trims down to the minimum, having a* C_v *or flow coefficient of* 0.07. *Manufacturers are the Crosby Valve & Engineering Co. Ltd.* **CPE 799**

Aluminium-based anti-rust primer

It is generally accepted that aluminium paints and primers are not inhibitors of corrosion (ironwork), although frequently and mistakenly used in industry for this purpose. A new product of Paripan Ltd., *Parinium*, is claimed to have definite anti-corrosive properties on ironwork.

Among other advantages claimed are high heat reflection properties, and improved adhesion to metal surfaces. **CPE 800**

Weatherproof junction box

The General Electric Co. Ltd. has extended its range of circular flameproof junction boxes to include a weatherproof one for use in exposed positions. Certified by the Ministry of Fuel and Power for use in gases included in Groups II and IIIa, the new junction box has been designed in cast iron to British Standard 229: 1957.

The weatherproof box is available in four-way or intersection pattern for both ¾ in. E.T. and 1 in. E.T. Each box is fitted with two steel stopper plugs, in opposite outlets. By altering the stopper positions, boxes can be used as two, three or four way. **CPE 802**

LABORATORY MILL

Small samples under 100 c.c. are quickly ground with the portable electric laboratory sample mill supplied by Glen Creston Ltd., which will handle grain, chemicals, drugs, coal and many other not-too-hard substances. It is 8 in. long by 4 in. wide, and weighs only 5½ lb. It is stated that practically no material is lost during grinding because the grinding chamber is very small; the transparent plastic hopper of 100 c.c. capacity closes dust-proof, and the slide-in glass receiver is tightly pressed against the grinding chamber by two springs, ensuring an effective seal. **CPE 801**

New American solvent

From America comes news of a new solvent, intermediate, and antistatic agent of extremely low toxicity, ethylsulphonylethanol. Developed by Pennsalt Chemicals Corporation, of Philadelphia, it is described as an easy-to-handle, white crystalline solid, readily supercooled. It is expected to have a wide variety of applications in the chemical, textile and pharmaceutical industries. It has uses, among other things, as a solubiliser, humectant, and antistatic agent in cosmetic and pharmaceutical formulations; as a removable antistatic agent for acrylic and vinylic films, fibres and fabrics; as an intermediate for novel chemical products such as plasticisers and monomers; and as a special solvent and coupling agent. **CPE 803**

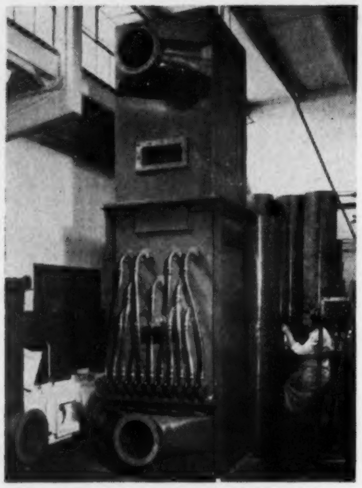
Resistance thermometer controller

For use in association with special fast-response thermometer elements, Foster Instrument Co. Ltd. are offering an electronic temperature controller covering temperature ranges from −50 up to +350°C. and the 15-in.-long scale is overprinted with the equivalent Fahreinheit range. The makers state that all resistances comprising the Wheatstone Bridge system are accurately calibrated and aged so that control point drift is entirely eliminated. The control operates on a differential of 0.1°C., but can be detuned to operate on wider differentials (up to 5°C.) if required by a simple adjustment of the sensitivity control. **CPE 804**

Low-pressure polythene

Wherever manufacturers are faced with a corrosion problem coupled with heat, the advent of low-pressure (high-density) polythene must be welcomed. Iridon Ltd. have developed a group of plastic sheeting materials which may be vacuum formed or fabricated as required by welding. The present outstanding application is for ducting. **CPE 805**

Open view of the weatherproof circular flameproof junction box.



PVC FOR METAL REFINERY

Shown here is a large scrubbing tower fabricated from Vybak VR215 *rigid sheet by Extrudex Ltd. The tower forms part of a fume extraction system used in metal refining and its purpose is to remove corrosive and noxious gases from exhaust ducting. The transparent flexible pipes are extruded from* Vybak VN610 *PVC compound. The PVC material is supplied by Bakelite Ltd.* **CPE 806**

Structural repair kits

Thistlebond repair kits now being marketed by Ferguson & Timpson Ltd. have been developed to meet the need for carrying out emergency repairs to machinery, equipment and piping.

Essentially, each kit consists of a supply of cold-setting epoxide resins and activators, and glass cloth, mat and tape for reinforcement purposes, together with the equipment necessary for applying the materials, such as scissors and brushes.

The kits employ *Ceemar* resins and activators supplied by E. M. Cromwell & Co. Ltd. and produced by Bakelite Ltd. **CPE 807**

Dirt-free, water-free fuels

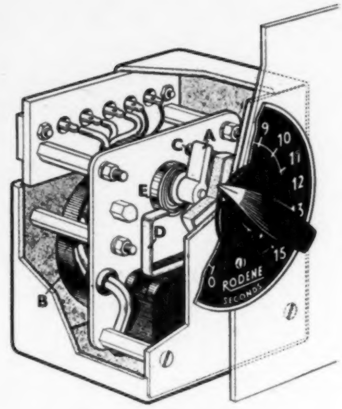
One of the main advantages of a new bulk fuel filter-separator unit introduced by the *Purolator* filter division of Automotive Products Co. Ltd. is that it is compact but performs two very important functions at one and the same time. The new *Purolator* filter-separator not only extracts water from the fuel but also any solid particles as well, thus eliminating the necessity of an additional filter.

Although intended primarily for aircraft refuelling installations, these filter-separators are equally suitable for use in diesel fuel storage depots, large engine test houses, dockside installations etc. In fact, they are useful wherever fuel is handled in bulk.

The efficiency of water removal depends to some extent on the operating conditions, but it is claimed that *Purolator* filter-separators have proved 99.98% efficient in most circumstances. All solids greater in size than 5 microns are removed by the filter together with a large proportion of smaller particles. **CPE 808**

Chemical-resisting protective gloves

Chemical-resisting protective gloves have been introduced by the protective equipment division of Martindale Electric Co. Ltd. The new gloves are suited to a variety of uses in the chemical industry as they afford protection against flame and chemical burns and many other hazards without hampering the wearer's movements. The tough PVC coating is bonded on to an interlock fabric lining. This internal support, whilst making the gloves more durable, does not reduce their flexibility. The number of seams has been reduced to a minimum and they are positioned away from wearing surfaces. **CPE 809**



PROCESS TIMER

A self-resetting synchronous timer has been added to their Rodene *range by D. Robinson & Co. It employs the instant-start self-clutching* Rodene *timer motor which makes possible the simple method of operation shown in this cut-away view of the new unit. There are four standard models, providing ranges of* 0-15 *sec.,* 0-60 *sec.,* 0-5 *min. and* 0-10 *min. The two longer period models have a built-in relay arranged to reset the mechanism at the end of the time period.* **CPE 810**

Fabric air filter

Research has been done at the works of Bivac Air Co. Ltd. with the object of providing a filter for industry which will cope with high dust loads in the order of 4 to 6 tons/hr., at the rate of 1,000 cu.ft./min. With such loadings a total dust retention has been registered as high as 99.7% with dust particle size down to 0.5μ.

The principle of the *Clear-Flo* is that the dust is collected on the outside of the tubes of filter cloth, using spring distended frames or springs to prevent the cloth from collapsing, the collected dust remaining on the outside of the cloth and, in general, dropping off by the pull of gravity. **CPE 811**

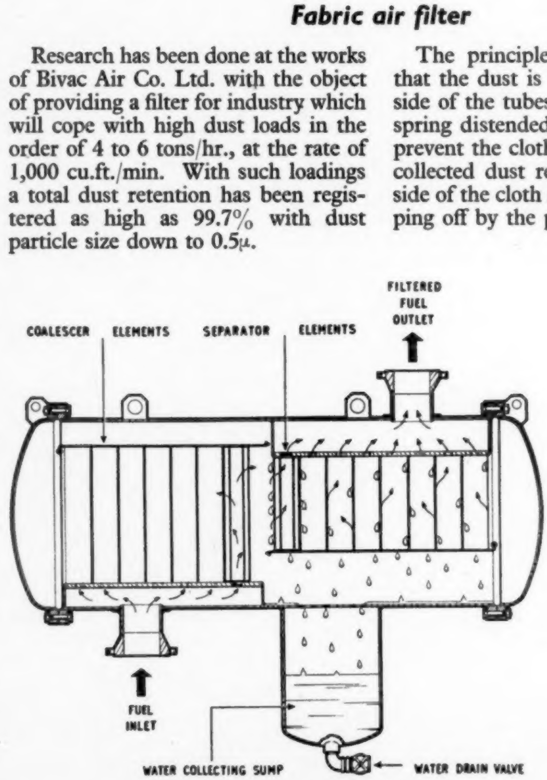


Diagram illustrating features of 'Purolator' filter-separator.

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We give below a complete index of all items of plant, equipment, materials and services described in our 'What's News' feature from January to November inclusive. Further information about any of these can be obtained by entering the CPE numbers on the reply-paid postcard at the front of this section and posting to us.

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